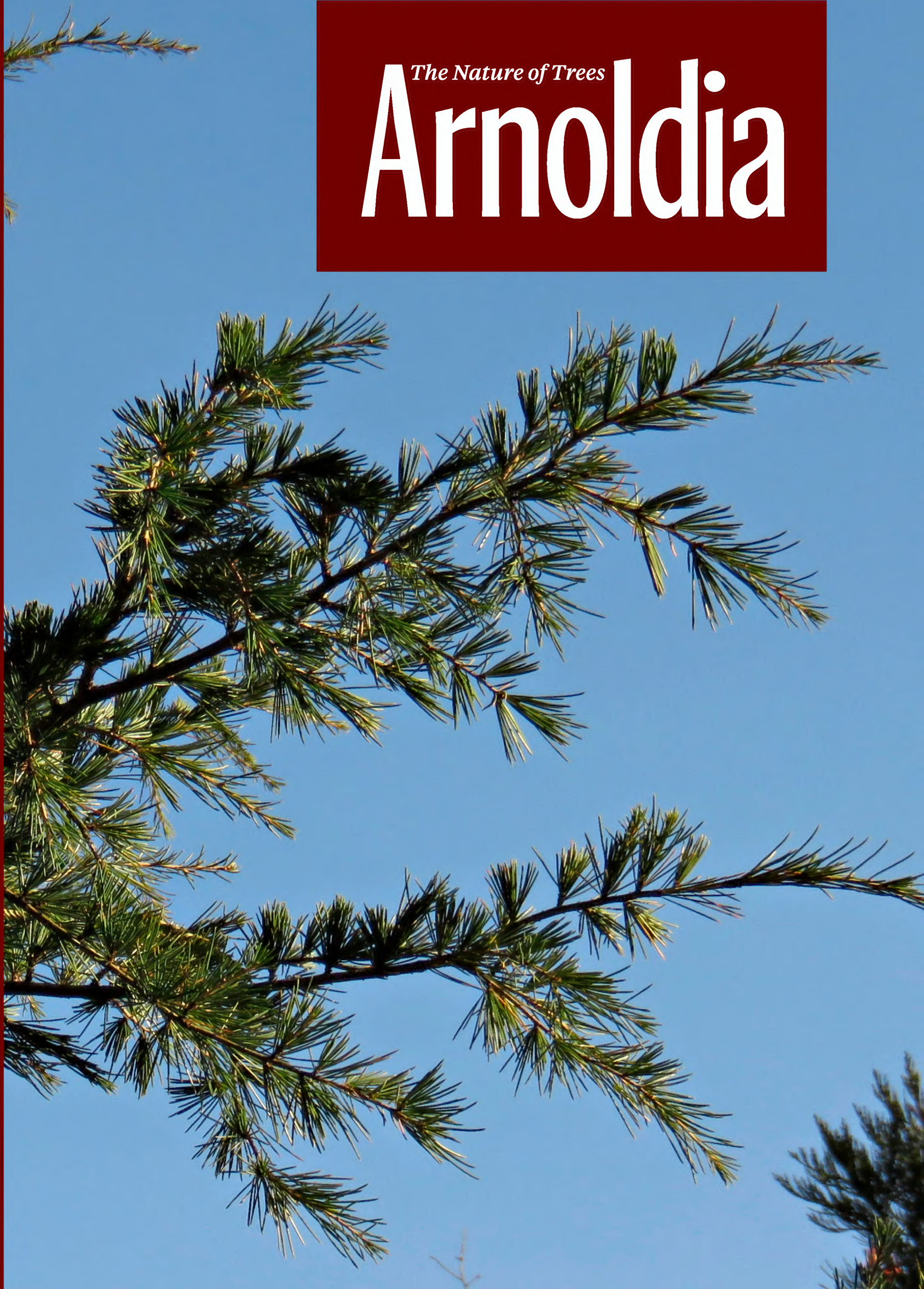


*Standing Dead   Franklin Park   Hopeful Monsters   Forest as State*

*FALL 2023*

*The Nature of Trees*  
**Arnoldia**









# What the Meadow Remembers

By Matthew Battles

Summer tilts into fall, and I go looking for monarch butterflies on Peters Hill. The late bloom is on the meadow, yellow-flecked with yolky dollops of tansy, while asters and the nodding umbels of Queen Anne's lace hover everywhere amid the green. It's the milkweed above all, however, that makes the meadow a monarch waystation: blooming singly here and there, *Asclepias tuberosa* or butterfly milkweed flares red-orange in the undergrowth, while the taller stems of *A. syriaca* or common milkweed, buckled and brown, lean into each other like tarnished candelabras. Bold in their black- and yellow-banded livery, the caterpillars feeding on milkweed here in late August will become the adults that fly all the way to Mexico. Last February, in the mountains of the Trans-Mexican Volcanic Belt, the great-grandparents of these caterpillars shivered loose from their winter shelter amid the branches of oyamel trees (*Abies religiosa*); soon, their descendants will return following the southgoing autumn. No single monarch travels the entire circle. What guides them along the way? How does such a memory—if it's reasonable to call it "memory"—take root in the world?

Both insects and memory may be said to teem, and the meadow is a crowded place, full of late-season insect life: crickets weave a blanket of buzz torn by sudden silences, grasshoppers popcorn out of the shadows to grasp at stems of grass, and bursts of late-season cicada song shimmer in the trees. My own Peters Hill memories come crowding, too—of summers past, in years before the Arboretum let the meadow grow uncut, when we climbed the hill on Fourth-of-July nights to watch fireworks bloom above the city. Or more recent recollections, like that of the coyote I watched one morning as it reclined in the shade of a hawthorn (*Crataegus*). It was the first year of the pandemic, the road below Peters Hill dotted with covid-weary visitors turning to the landscape for respite. The coyote watched them unseen, and I watched its watching until it stood to stretch, yawn, and rake a mouthful of ripe haws from a low-hanging branch before trotting off.

Memory traces abound on Peters Hill. A path cuts sharply through the timothy and vetch, a vein of bare soil compacted by visitors marching upslope and down. Joggers and dogwalkers seek the most direct route to the top, and the hill remembers their efforts. The dirt of the path is studded with rocks; when the rains come, they roll out with the



waters draining off the summit, leaving an outwash delta smeared across the grass at the base of the hill. This sediment is glacial till, piled here by the churning of the kilometer-thick ice sheet that covered Boston until about twenty thousand years ago. Drumlins like Peters Hill are the memory of its passage. Landscape architect Rosetta Elkin has described the Arboretum's drumlins as "remnants of a larger erased regional landscape of undulating, swelling, sloping life grounded in the contours of the earth's past." Boston "was built from the extracted hills," she notes, in a process of development "that did not really see the virtues of the landscape." By incorporating these hills in the design of the Arboretum, Elkin suggests, Olmsted and Sargent undertook an act of preservation, of deep-time memory.

Across the brow of Peters Hill, butterflies orbit here and there, urgent in their looping flight. Stomping through dew-wet turf at the meadow's mowed edge, I count some half-dozen individual monarchs on patrol. Some circulate intently, sailing long reaches over the bobbling blooms before coming about, while others coast down the wind with paper-airplane aplomb. They show no preference for north or south; at home in their ellipses, they are content to browse the meadow.

To find their way up and down the continent, monarchs rely on textures of sunlight that shift with the days and the seasons. Equipped with a neurological "sun compass," they take their bearings from the sun's polarized light, which orients them to the advance of spring and, now, to autumn's south-slipping radiance. These inputs are coordinated in the "mushroom bodies"—specialized clusters of dendrites in the insect forebrain that convert sense into learned behavior. Dendrites, mushrooms—trees and fruiting bodies rise in the minuscule garden of the insect brain and flower into memory. It is thought that their wayfinding also relies on magnetic fields, temperature, and a host of other sensory cues. The migration, then, is a memory made of many things: shifting angles of light, the rolling bloom, the bitter taste of milkweed.

Such a memory is less like a written record than a performance, or a collection—or perhaps a meadow.

Such a memory is less like a written record than a performance, or a collection—or perhaps a meadow.

Certainly, it is more than a map of the route from Maine to Michoacán—for it tells the milkweeds' tale, too. With the retreat of the same ice sheet recorded in the gravel and drift of Peters Hill, *Asclepias* spread north into the meadows of North America. Investigators also have suggested that the monarch's migratory flight remembers the colonial deforestation of the continent, which created a bounty of new open-field landscapes for milkweeds to flourish. The great annual migration of the butterflies, then, might be understood as the reenactment of these millennial metamorphoses of climate and biome, danced by the butterflies on the wheel of the year. Or why not call it a memory, vast as a continent, written in brightness and bloom, slant of light, shift of temperature?

Elsewhere throughout the Arboretum, deep-time memories abound: hedgeapple and honey locust recall hungry mastodons; the ginkgo offers up its smelly seeds and dreams of dinosaurs. I realize, however, that calling such relations "memory" might not sound right to some. Is it meaningful to claim that the monarch *remembers* the retreat of the glaciers, the advance of the milkweeds, and the clearing of the trees? Perhaps it is more palatable to say that they are part of a broader memory system, which is the memory of the earth. And we too are particles of this planetary memory. For the Arboretum is more than a topographical archive; it's crucially a library of biodiversity, a living memory, which takes shape in the generation-spanning work of curation and care as much as in living plant tissue. Like a sun-compassing butterfly; like a murmuration of starlings; like a forest. I started out wondering what kind of memory persists in the mind of a monarch; high on Peters Hill, I find a saving hope in the recognition that we are memories ourselves. 🌿

MATTHEW BATTLES is the editor of *Arnoldia*. He is writing a book about the natural history of memory.



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*The Nature of Trees*

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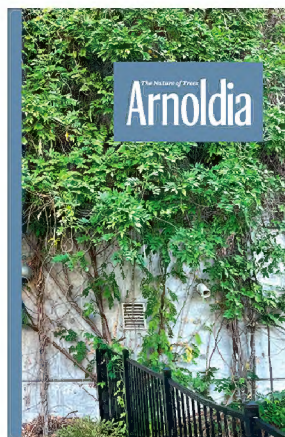
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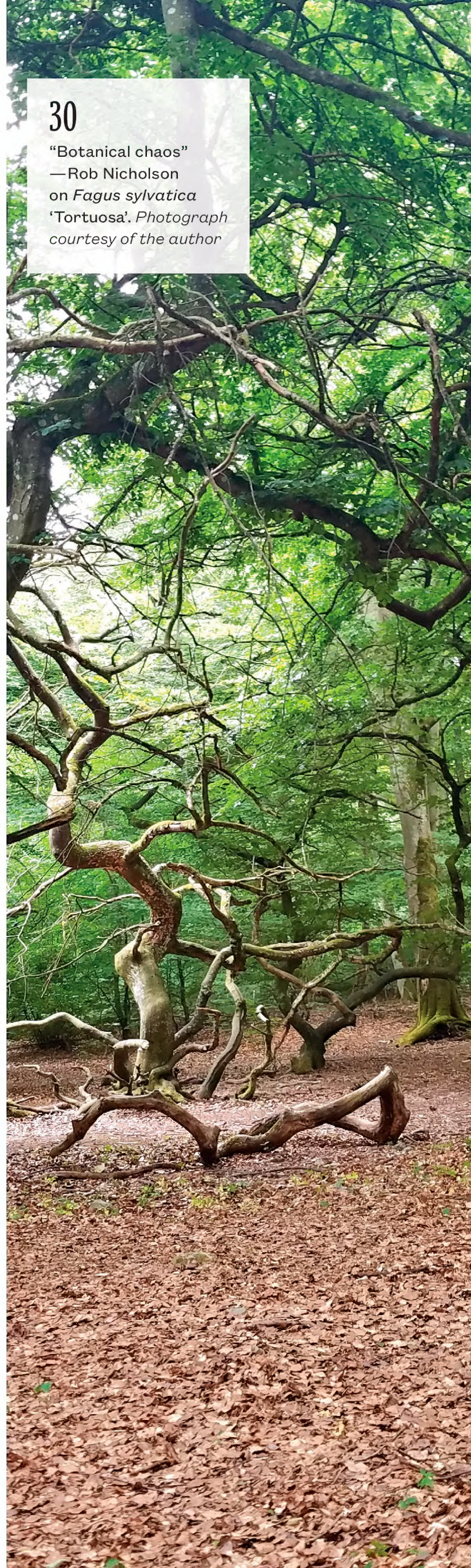
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30

"Botanical chaos"  
—Rob Nicholson  
on *Fagus sylvatica*  
'Tortuosa'. Photograph  
courtesy of the author





1

**From the Editor**

What the Meadow Remembers  
*By Matthew Battles*

6

**Notes from the Field**

Thomas Clark, Emily Ellingson, Martin Nicholson, and Ben Stormes explore a fire-scarred forest; Michael Bradshaw finds beauty and diversity in pathogenic powdery mildews; John Berryhill learns from mountain magnolia in southwest Virginia; W. Wyatt Oswald reads the life of a lost tree.

16

**Plant Portrait**

Standing Dead  
*By Galen Bunting*

46

**Poetry**

The Elms, or Trans-sensory Experience,  
Courtesy of Santiago Ramón y Cajal  
*By Louis Girón*

56

**Propagations**

ART ENTANGLED  
Night Trees  
*By Shuchi Saraswat*

INTERVIEW  
Sean Hoban on Genetic Diversity  
and Diplomacy

64

**Season in Practice**

A Plant Explorer’s Packing List  
*By Miles Schwartz Sax*

**Features**

18

LANDSCAPE HISTORY

**The “Large Park”  
of the System**

*By Ethan Carr*

28

TREES OF LIFE

**The Hopeful  
Monsters of Skåne**

*By Rob Nicholson*

38

FROM THE ROOTS

**Not the Nation,  
But the Forest State**

*By Sumana Roy*

48

VISUAL ESSAY

**Forest Fashion**

*By David Buckley Borden  
and collaborators*



**Cover**

*Cedrus deodora* ‘Shalimar’, cultivar of  
Himalayan cedar (1127-64\*A). *Photograph  
by Kyle Port*

**Inside front and back covers**

*Illustration by Shyama Golden*



# Notes from the Field



Arnoldia | Fall 2023



## Searching Siskiyou

Collecting Sadler's oak and Brewer's spruce in the Pacific Northwest, a team of plant investigators develops a fresh appreciation for the fertile ferocity of fire.

**Thomas Clark,**  
Mount Holyoke  
College B.G.;  
**Emily Ellingson,**  
Polly Hill  
Arboretum;  
**Martin Nicholson,**  
Hoyt Arboretum;  
**Ben Stormes,**  
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We made our way along a winding path that followed the contours of the land toward Babyfoot Lake, often clambering over or under massive trunks of conifers strewn about like enormous toothpicks. Countless trunks were still standing, their bases fire-scarred below the barkless, weatherbeaten, ashen-gray pillars supporting an overcast sky of nearly the same hue. They made for a ghostly reminder of the ravages visited upon this landscape in the recent past—even as a new forest in every shade of green was emerging in stark contrast among the standing dead. It was in this

landscape that, with great support from the American Public Gardens Association and United States Forest Service (USFS), we were headed out to find *Quercus sadleriana*, Sadler's oak. The Global Conservation Consortium for Oak has identified many species of North American oaks requiring more research and collection work, and Hoyt Arboretum has chosen to be the species champion for *Q. sadleriana*. As we set forth, the signs and impacts of fire on the landscape soon became as familiar as the individual voices and laughter of each of us in our small company.



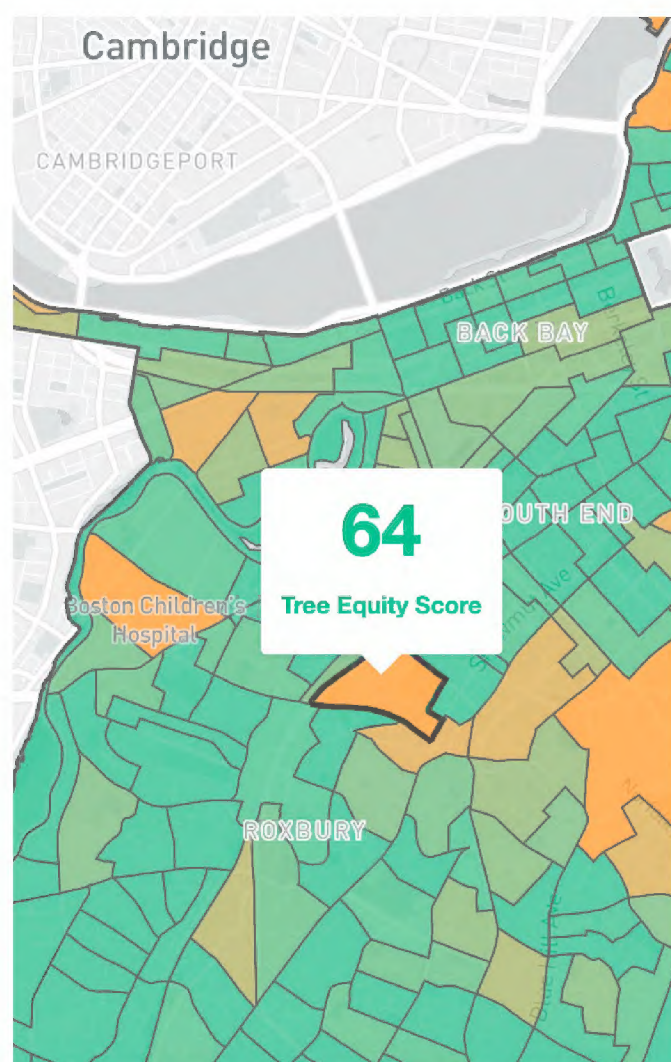
We were walking in the Kalmiopsis Wilderness in Rogue River-Siskiyou National Forest, home to landscapes marked by numerous fires over the last two decades. Fire, of course, is a natural part of the ecology in northern California and extreme southwestern Oregon where we spent the better part of two weeks in September 2022. The physical and ecological impacts of fire are many and complex—but overall, it is regenerative. For centuries, indigenous peoples understood this and used fire to their advantage. Together, human-ignited fires and natural ignitions led to the regular occurrence of low- to moderate-intensity fires that helped maintain an ecological balance. Fire-suppression policies implemented in the twentieth century, however, along with a changing perspective on the human relationship with forests, began to upset that balance. Forests grew denser, fuel loads increased, and forests became less fire-resilient, all conspiring to heighten the likelihood of massive, difficult-to-control fires that would have deeper, more detrimental ecological impacts. Climate

change is exacerbating this situation on both the landscape scale and at the level of the individual taxon.

This sobering fact underscored the importance of what we were doing (and the work of botanic gardens and arboreta the world over) and lent a sense of urgency to our daily activities. Drive, hike, see, observe, record, collect, learn, enjoy the company of like-minded friends, and ask questions. Repeat. Although uncertainty surrounds the fate of many species that we saw, *ex-situ* conservation has a distinct role to play in long-term stewardship. With dedicated and careful attention in the months and years ahead, the seed we collected will grow into plants that will find their way into our arboreta and gardens, as well as many others throughout North America.

Previous attempts at collecting *Quercus sadleriana* in California had found plants with few acorns; however, this year would be different. Headed into the field, we were supplied with a good account, furnished by a USFS botanist, of a large population with maturing acorns. We proceeded up

Drive,  
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## GREEN CITIES

# Tree Equity Score Analyzer

In urban areas across the U.S., a pattern has become all too familiar: socioeconomically disadvantaged districts and neighborhoods of color have fewer trees than their whiter, wealthier counterparts, meaning these areas do not receive the myriad benefits trees provide. To promote awareness of environmental justice, American Forests created the Tree Equity Score Analyzer—a tool allowing users to understand cities through exploring maps, evaluating data, and creating optimal scenarios for tree planting and carbon sequestration. Each neighborhood is assigned a Tree Equity Score based on “tree canopy, surface temperature, income, employment, race, age and health factors.” Recently this tool added data expanding its reach to more than 200,000 neighborhoods—including those in the Boston Metro area. Unsurprisingly, the Arboretum has a perfect score of 100, though the same can’t be said for other areas.

—Jamila dePeiza-Kern



ever-narrowing forest service roads climbing into a previously burnt-over forest. *Q. sadleriana* has a distinctive leaf, oval and serrate like chestnut, which stands out from the other shrubby material. Reaching our target GPS points, we found a large population of Sadler's oak covering the hillside, with a robust and plentiful mast. Given the research and conservation priority assigned to *Q. sadleriana*, and the Hoyt Arboretum's mission to champion the species, we were thrilled to find this species doing very well in the post-fire landscape, with acorn maturity that was perfect for collection. We filled seed bags and made collection notes, a satisfying pattern to repeat with this target species over the next three days.

Another target tree, the chosen illustration on the cover of our field notebooks, was the magnificent Brewer's spruce, *Picea breweriana*. With its shallow root system and aversion to sun contributing to poor regeneration after fire, this vulnerable endemic conifer is under threat. It has found its niche, however, in disjunct populations on often steep and north-facing slopes in montane chaparral and climax communities.

Our search for the drooping green-blue branches of Brewer's spruce began as we made our way through southwest Oregon, Douglas fir (*Pseudotsuga menziesii*) foiling our eager eyes on numerous occasions. Occurrence records from herbarium specimens from a 2017 trip by the Royal Botanic Garden of Edinburgh guided our route. We arrived at one site crestfallen, finding a desolate landscape recently burned to a crisp where there should have been a stand of Brewer's spruce. The Slater Fire raged through this area in 2020, and probably took this particular occurrence with it.

This disappointment made our discovery of Brewer's spruce in the Klamath National Forest that much sweeter, however. Beholding its unforgettable, pendulous form, we were very unlikely to mistake it for Douglas fir ever again. A worn path showed that others had visited this tree, and we took the utmost care to collect only what was needed. In our excitement, we forgot to

A soft  
cracking  
could be  
heard as the  
cone scales  
separated,  
and we  
watched  
wide-eyed  
as the seeds  
within were  
finally  
revealed.

send up a collecting bag with our climber, and for a good fifteen minutes, we on the ground caught the sticky cones that rained down from the heavens as he swayed in the breeze at the top of the world.

This was not the last time we saw Brewer's spruce. We witnessed its beauty in the Miracle Mile of Conifers in the Russian Wilderness, a one-mile stretch that boasts some of the greatest conifer diversity in the world. And our hike to Babyfoot Lake, a region regenerating after the 2002 Biscuit Fire, led us to trees that survived on rocky, protected slopes. In a moment of melancholy, we found that an ignorant lakeside camper had chopped down a Brewer's spruce sapling for firewood, highlighting the importance of respect for nature and the importance of both in-situ and ex-situ conservation of this species.

While on the hunt for *Picea breweriana*, we followed Forest Service roads that snaked through the undulating landscape, and at a fork in one such road we took a moment to break for lunch. All around, the largest trees showed bold fire scars 10 feet up their trunks, yet retained lofty canopies high above a vigorous understory of shrub thickets and young trees. A prominent component in the regenerating mid-story forest were stands of *Pinus attenuata*, the knob-cone pine.





The young knobcone pines stood between 8 and 15 feet, the larger specimens adorned with tapering downturned cones pressed tightly against the upper trunk. Mature cones remain closed until the next fire sweeps through, so we could count down the trunk that these trees had been reproductive for half a dozen years, the oldest cones still tightly closed. We collected cones of various ages, along with acorns of *Quercus vaccinifolia*, a prominent scrub oak at the site.

The cones collected along the two-week journey were stored in cloth bags, and by the end of the trip most had dried to the point where they were easily shattered or opened on their own. Those from the knobcone pines, however, remained firmly closed. Fire is the force needed to unlock them. On our final day, safely back at the Hoyt Arboretum in Portland and with new tools at our disposal, we ignited a blowtorch and passed it over the *Pinus attenuata* cones. We were mesmerized as the dry, hard resin covering the cones melted before quickly boiling then vaporizing under the heat of the flame. Within minutes, a soft cracking could be heard as the cone scales separated, and we watched wide-eyed as the seeds within were finally revealed. After seeing entire landscapes ravaged by fire throughout the trip, this final act of seed collecting using fire as a necessary tool was a reminder that there exists a delicate balance in nature, and that even something as destructive as fire can be required for new life. 🌿

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# Closeup on Powdery Mildew

Michael Bradshaw unveils the beauty and diversity of plant-pathogenic fungi.



Arnoldia | Fall 2023

Hidden amid the vast and diverse array of plants in botanical gardens, a world of thousands of plant diseases thrives. Amidst the vibrant blooms and lush foliage lurk plant pathogens that are ready to infect a diversity of hosts. These organisms take many forms, from leaf-devouring fungi to viral assailants capable of transforming a healthy plant into a yellow, withering mass. The garden in essence becomes a living petri dish, nurturing and sheltering pathogens. Gardeners and horticulturists often go to great lengths to shield these diseases from visitors and scientists alike. However, these unsightly and potentially deadly afflictions can only remain concealed for so long; one infamous plant pathogen,

**Michael Bradshaw** completed his Ph.D. at the University of Washington in Plant Pathology and is currently a Harvard University Herbaria fellow studying powdery mildews and their hosts.

*Phytophthora infestans*, is credited with causing the devastating Irish Potato Famine, claiming over a million lives. Closer to home, the chestnut blight caused by the fungal agent *Cryphonectria parasitica* forever reshaped American forests. As a plant pathologist, I find these tiny organisms possess a captivating allure despite their destructive nature. Under the microscope, delicate threads of fungal hyphae weave intricate patterns upon infected leaves. To the trained eye, these are akin to nature's abstract art; the vibrant hues of rusts, smuts, and leaf spots present an unexpected visual appeal.

Fungi are among the least studied organisms in terms of their diversity, and this is especially true for powdery mildews, among the world's most common plant pathogens. Powdery mildews, which should not be mistaken for the mold or mildew growing in your shower, are a group of some one thousand species of fungi that infect over ten thousand species of flowering plants, including such favorites as hops, marijuana, and wine grapes. Achieving effective control of powdery mildews through organic methods poses a formidable challenge. What's worse, these pesky, pervasive fungi tend to evolve resistance to the synthetic pesticides available. In a garden, it's often more practical to find ways to coexist with these pathogens, or to choose plant varieties that are naturally resistant to powdery mildew. Through millions of years of evolution, they have honed their ability to efficiently target plant organisms. At the same time, as biotrophic parasites, powdery mildews have undergone adaptations that prioritize the preservation of their food source. One of the evolutionary traits they possess is the development of a specialized feeding organ called the haustorium, which allows them to extract nutrients from their hosts while avoiding lethal damage. However, while they spare the host's life, they can still wreak havoc in other ways. For instance, they can lower crop yields in agriculture and damage the leaves and flowers of ornamental plants, making them unsuitable for sale.



One fascinating aspect of many fungi, including powdery mildews, is their ability to exist in both asexual and sexual forms during different parts of their life cycle. Powdery mildews exemplify this by undergoing a striking transformation from their asexual form, sometimes seen as a chain of spores resembling white, translucent pillars on leaves, to their sexual form, which takes on the appearance of alien-like spheres with long tentacles. These unique structures serve as the fungi's fruiting bodies, allowing them to survive the winter and infect new hosts in the following spring. While they may be unsightly, powdery mildews possess a captivating beauty and complexity when viewed through the lens of a microscope.

The past decade of my research has been dedicated to these tiny fungi, and they have become a special passion. My work revolves around identifying and naming the various species found in North America. To effectively manage the diseases they cause, it's crucial to accurately identify plant pathogens. Different pathogens may require specific control measures, from targeted fungicides to the cultivation of resistant plant varieties. Precise identification also enables us to track and monitor pathogen populations, allowing for the early detection of newly introduced pathogens and undertaking intervention in a timely manner. Interestingly, species of powdery mildew are narrowly specific to their host plants. So, if you have powdery mildew on your peony, don't worry—it won't infect your lovely chestnut or even your roses (although another species of powdery mildew might!).

As a passionate powdery mildew hunter, knowing the best hunting grounds is key to success. It's no surprise that botanical gardens, with their diversity of plants, hold a treasure trove of powdery mildew species. To boost my collection efforts, I recently contacted horticulturists and gardeners in botanical gardens across North America. In just a few weeks, we discovered a whopping 30 new species of powdery mildews! As renowned mycologist Amy Rossman once remarked, "(f)or some types of organisms, such as microfungi, New York state's forests

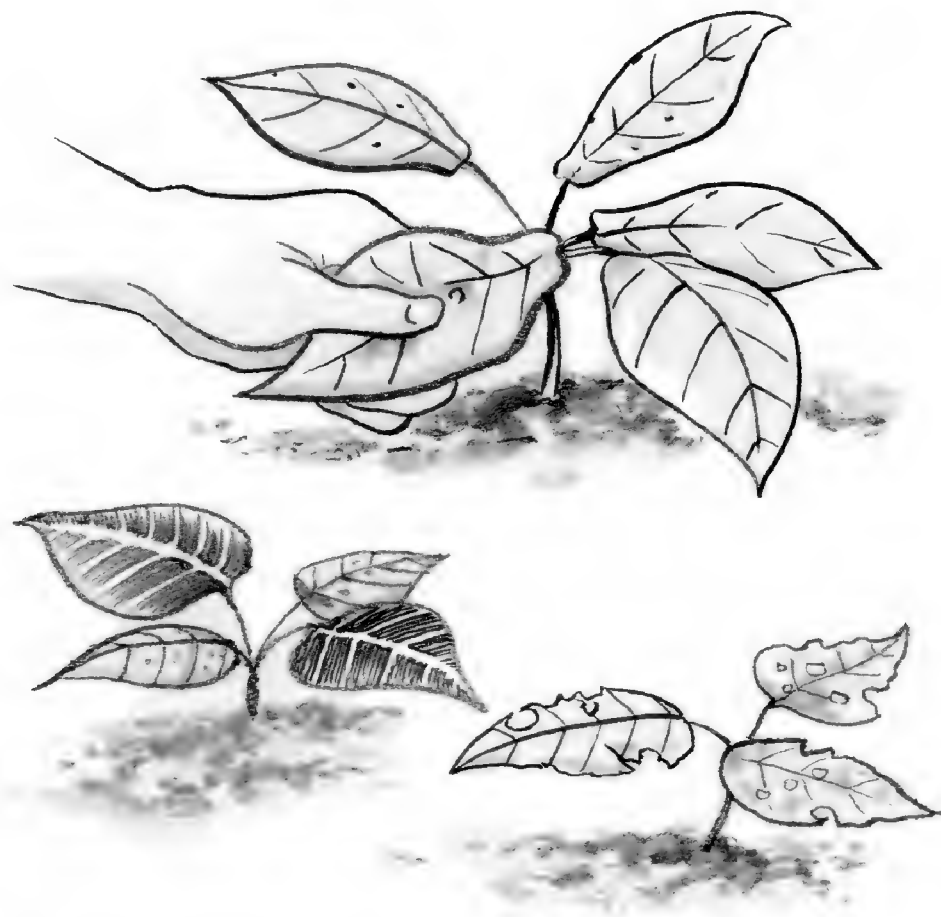
When it comes to plant-pathogenic fungi, the biodiversity of the Arnold Arboretum is as uncharted as the Amazon rainforest.

are almost as unexplored as the tropical forests." Taking it a step further, I'd say that, when it comes to plant-pathogenic fungi, the biodiversity of the Arnold Arboretum is as uncharted as the Amazon rainforest. Just as we strive to protect tropical forests, recognizing the importance of microfungi and exploring their habitats can deepen our knowledge, address global challenges, and contribute to their conservation.

If you're interested in delving into the world of powdery mildew (or other fungus or plant-pathogen) collecting, it's important to familiarize yourself with the fungi and their host plants. Start by identifying common host plants like roses, cucumbers, or sunflowers, then learn to recognize the signs of infection. Time your collections to capture both the asexual stage in spring/summer and the sexual stage in fall. When selecting specimens, opt for plants showing distinct powdery patches on leaves or the black dots of the sexual stage, and check both sides of the leaves. Handle the samples carefully, placing them in labeled paper envelopes or bags. Ensure the valuable specimens find their way to a local fungarium or research institution, where they can contribute to scientific endeavors and expand our understanding of powdery mildew diversity.

Exploring plant pathogens within botanical gardens offers a fascinating glimpse into the intricate dance between plants and their microscopic foes. The vast array of powdery mildew species discovered in these environments highlights their remarkable adaptability and resilience. Just as "plant blindness" refers to the inability to appreciate the significance of plants, I hope this article can cure your "powdery mildew blindness." Once cured, you'll no longer overlook the incredible diversity and captivating beauty of these common plant pathogens. So, whether you're strolling through the Arnold Arboretum or simply wandering around your own garden, be sure to take a moment to admire these charming and striking fungi. 🌿





## Learning to Build Collections from the Forest

Collecting mountain magnolia on the slopes of southwestern Virginia, **John Berryhill** asks, what do the plants need from us?

**John Berryhill** is the landscape curator for the Botanic Garden of Smith College, where he is working to bring conservation horticulture to the forefront of the collection-building priorities.

One could say my path to a wooded Virginia mountainside started with a stroll through the Arnold Arboretum accompanied by Michael Dosmann, the Keeper of Living Collections. My career at the Botanic Garden of Smith College had recently taken a turn away from a primary focus on arboriculture and toward the world of curation, and it seemed wise to connect with someone with Michael’s vast experience. The question of how to build collections and serve institutional missions is not as straightforward as it once was. Simply believing that “more is better,” or that a token example of a rare species will suffice, ignores what has been learned by the public garden and arboretum communities as we study our past and envision our future—to act as a voice *for* the plants, rather than just as collectors of them.

One manifestation of this shift can be seen in the work of Botanic Garden Conservation International (BGCI) and the Global Conservation Consortia (GCC). With around 60,000 described tree species (of which approximately a third are at risk of extinction), arboreta must urgently determine how to apply their resources to achieve the greatest impact on the conservation of biodiversity. That goal is central to the work of BGCI and the GCC, arising from the recognition that while some genera of trees are rich in rare or small-range species, their genetic diversity cannot be conserved through seed-banking alone. The seeds of these “exceptional species” do not remain viable over time. They must instead be held in carefully planned *living* collections that adequately represent the complexity and resilience of each species’ genome while also incorporating an appropriate amount of redundancy in case of tree loss. A conservation collection could require hundreds of trees, giving rise to the idea of a “meta-collection” (or collection of collections) with the effort being shared by a coordinated network of institutions. The GCC model has flipped the traditionally competitive idea of collections-building that viewed plants as “collectibles” into a more collaborative approach that asks, “what do plants *need* from a collector?”

During my graduate studies it was my good fortune to be partnered with Dr. Jesse Bellemare of the Smith College Department of Biological Sciences. I was grappling with the big questions surrounding the purpose of botanical collections. Jesse is a plant ecologist who researches the condition of native magnolias in the southeastern United States under climate change. My thesis investigated whether the recruitment dynamics (the capacity of a species to add new members to a population) of mountain magnolia (*Magnolia fraseri*) were being affected. Jesse’s prior work with umbrella tree magnolia (*Magnolia tripetala*) showed a trend of declining recruitment along the warm (southern) range margin. As its name suggests, mountain magnolia is a montane species, happiest at about 2,000–4,200 feet



in its native southern Appalachian range. We suspected that a similar trend would play out along the elevational gradient that this species occupies.

Our efforts brought us to the heart of mountain magnolia's range—the Mount Rogers National Recreation Area in southwestern Virginia. This botanically rich region holds the legacy of the refuge it provided from the reach of glaciers during the last ice age. Our surveys and seed collecting expeditions carried us through the familiar—the maples, birches, and viburnums we knew so well from New England forests—to the dazzling array of plants that make the southern Appalachians so special to botanists. Walls of rosebay rhododendron (*Rhododendron maximum*) and greenbrier (*Smilax rotundifolia*) were simultaneously beautiful and daunting to crash through. Crane-fly orchids (*Tipularia discolor*), heartleaf (*Hexastylis minor*), and wandflower (*Galax urceolata*) were exciting to behold, but quickly overshadowed by bright blazes of red, orange, and purple courtesy of the fungal kingdom. Some mushrooms were so vibrantly colored that, for an instant, they could be mistaken for litter. One of our trips brought us to the area in early October, where the prize for “lasting impression” went to the sourwood trees (*Oxydendrum arboreum*). Their display of electric red would put even the proudest red maple to shame. All of this made the long days of zig-zagging over steep terrain, sloshing through downpours, and meticulous attention to detail endlessly invigorating.

The data we brought back was astoundingly clear. Ecological data are often messy and require advanced statistical analysis, but this was not the case here. Our work aimed to detect a difference between the average elevation of mature trees and that of seedlings. The elevational distribution of mature canopy trees would indicate the past climate envelope that had supported their recruitment. Seedlings are far less tolerant of extremes and variance in climate and would be expected to show a distribution that had shifted or contracted upslope in a quickly warming/drying climate. This

Arboretum trees are not just objects in a museum but rather representatives of living communities that require advocacy and understanding.

is exactly what we found. The average elevation of the more climate-sensitive seedlings was more than seven hundred feet higher than the mature trees. Furthermore, there was almost no recruitment in the lower two-thirds of our survey area. The elevation of most efficient recruiting was, in fact, around the single highest tree we could find—historically where mountain magnolia meets the limits of its cold tolerance. Aging seedlings by counting bud scars on the stems, we confirmed that this was a sustained trend. Further investigation of growth rings from core samples revealed a similar trend of significantly declining growth rates for mature trees in the warmer (lower) elevations.

The picture painted by these observations is not apparent with just a quick glance. A range map shows a species with a modest distribution from the mountains of northern Georgia up through West Virginia. For the most part, a walk in those mountain forests would reveal healthy-looking trees. A peek at the IUCN Red List shows that *Magnolia fraseri* is regarded as a species of least concern for conservation, further noting that populations appear stable and not threatened. That assessment is hard to square under close inspection. If mountain magnolia were on the verge of large-scale extirpation from much of its range because of a shift in the climate envelope, the first signs would be declining growth and failure to recruit on the leading edge of that change.

Getting out into the forests reminds us that our arboretum trees are not just objects in a museum but rather representatives of living communities that require advocacy and understanding. As a curator, it has been invigorating to think of collections-building at the Botanic Garden of Smith College with this story, and others like it, in mind. Our aim is to bring students at Smith into the multidimensional work of modern botanic gardens—where not just botanists are needed, but storytellers, politicians, artists, data scientists, and new voices that can help us determine how a plant collection “for the plants” should really look. 🌿

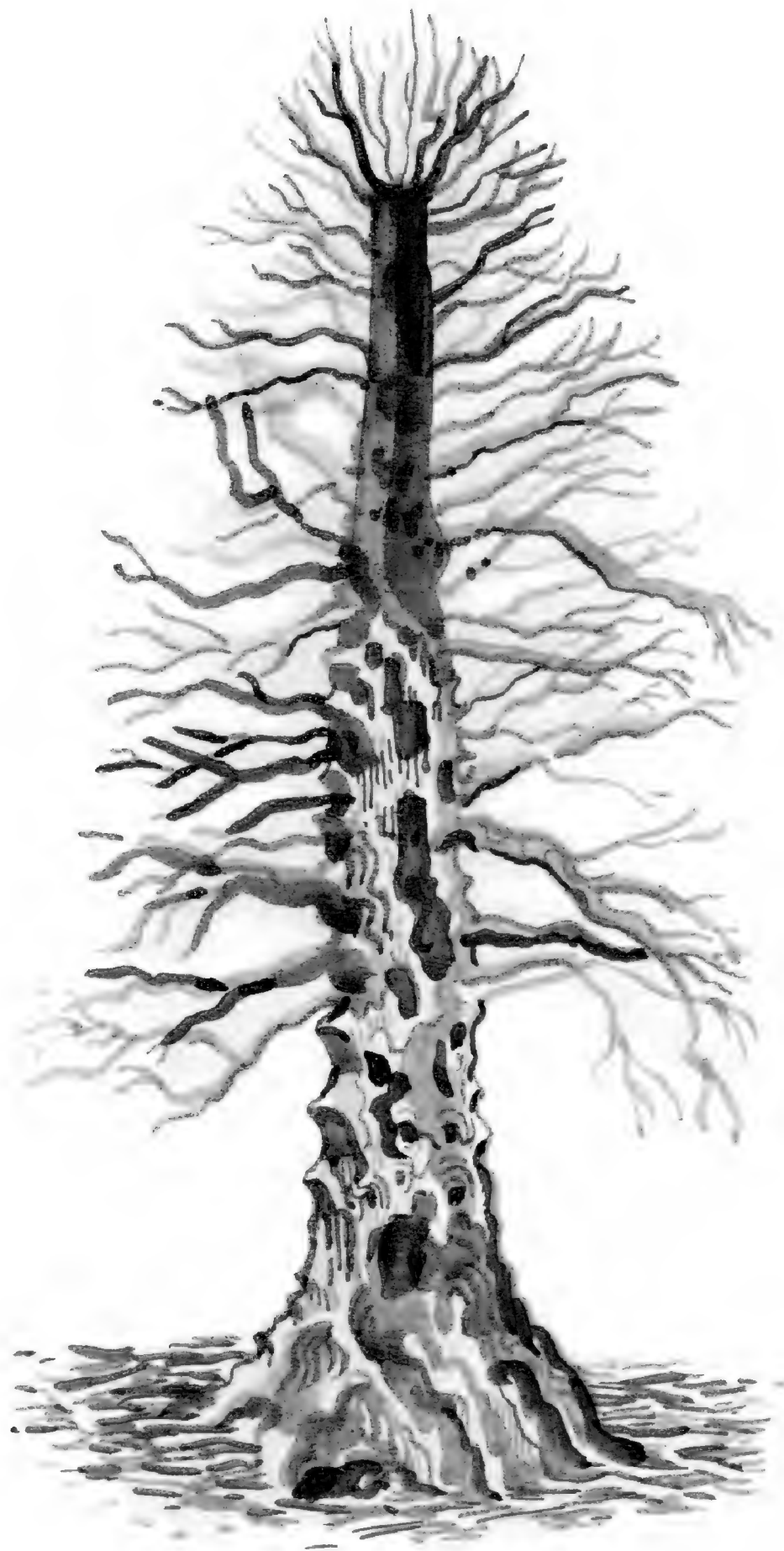


# Requiem for an Eastern Hemlock

W. Wyatt Oswald investigates an ancient tree lost to an invasive insect

My heart sank when I saw the pile of bark at the base of the tree. I knew its demise was inevitable, yet finding the tree dead still brought a sense of sadness and loss. I called it MHB-4, an underwhelming codename for an overwhelming tree. It was a majestic eastern hemlock (*Tsuga canadensis*), growing on a rocky slope above a small stream called Meeting House Brook (i.e., MHB), on the west side of the Middlesex Fells Reservation, a large piece of conservation land not far from Boston.

I had been aware of this sizable—65 cm (~26 inches) in diameter—and presumably old tree for 15 years or so. Like thousands of other people, I first encountered the hemlock when I walked within a few feet of it while hiking the Skyline Trail, a challenging path that circumnavigates the western half of the Fells. I suspect that many hikers walked past MHB-4 without paying much attention, lost in conversation or engrossed in thought or a podcast. Others, though, including folks with an interest in natural history or ecology, or just an appreciation for great big trees, would have felt some surge of emotion—awe, respect, admiration, joy—when they came upon this stately hemlock.



**W. Wyatt Oswald** is an environmental scientist and professor in the Marlboro Institute for Liberal Arts & Interdisciplinary Studies at Emerson College.

I experienced all of those emotions, but as a scientist with an interest in the long-term history of New England forests, the main reaction I felt upon encountering MHB-4 was curiosity. I wanted to learn more about this stunning tree, its neighboring hemlocks, and their experiences over the past decades and centuries. So, after visiting the tree periodically over ten years or so, I requested a research permit from the Commonwealth of Massachusetts,



and I returned to Meeting House Brook in 2016 with my student Jinghan Zhu, then an undergraduate at Emerson College, and my daughters Alta and Piper, ages nine and seven. We were armed with a forest-ecology tool called an increment borer, a metal tube with sharp threads at one end and a stiff handle at the other; it collects a cylindrical core of the wood, approximately the diameter of a chopstick, from near the base of the tree.

We took turns with the borer, rotating the handle clockwise as we cored inward, trying to hit the bullseye—the innermost annual rings, grown at the beginning of the tree’s life. For MHB-4 and its neighbor MHB-5—even larger at 71 cm (~28 inches) in diameter—the centers of the trees were rotten, so I wasn’t able to determine their years of establishment. But for the outer portion of the core, which hadn’t rotted, I glued the sample into a wooden tray, sanded the wood smooth with progressively finer sandpaper, then counted and measured the annual rings under a microscope.

For MHB-4, I counted and measured 116 tiny tree rings in the outer, unrotten 15 cm (~6 inches) of wood. The MHB-5 core was 19 cm (~8 inches) long and comprised 162 annual rings. Thus, the trees averaged about eight years of growth per centimeter for those sections of core. Extrapolating that rate of growth inward, through the rotten centers of the trees, yields establishment dates of around 1750. However, figuring the rates of growth slowed as the trees aged and began to compete for sunlight with neighboring trees, it seems likely that the trees established a bit later, perhaps around 1800. In any case the trees were old, and probably among the oldest trees in eastern Massachusetts, an area of young forests given its land-use history—deforestation by European colonists in the seventeenth century, widespread agriculture until the mid-nineteenth century, and heavy use of any remaining woodlots. MHB-4 and MHB-5 came through the 1800s unscathed, presumably because the slope above Meeting House Brook was too steep and rocky for the cultivation of crops and, at the time,

The trees were old, and probably among the oldest trees in eastern Massachusetts

the trees were too small to be worth harvesting. Then, in 1894, the Fells and its trees were protected as part of the Metropolitan Park System.

Despite this protection from logging, MHB-4 faced various stressful events over its long life, including regular windstorms and multiple droughts. Hemlocks like moist soils, so it’s likely that periods of low precipitation will be recorded in the pattern of wide and narrow tree rings. Indeed, particularly thin rings, marking hard times and reduced vigor, occurred in the MHB-4 core during the regional drought of the mid 1960s and again during the drought and coincident outbreak of spongy moth in the early 1980s.

The tree rings of hemlock MHB-4 began to narrow again around 2013. This is, unfortunately, when the hemlock woolly adelgid (HWA) arrived at Meeting House Brook. HWA is a tiny, aphid-like insect native to Asia, introduced to the mid-Atlantic region in the 1950s. The insect reproduces quickly and disperses readily, enabling it to spread rapidly across the eastern U.S. over the last several decades. HWA feeds on sap at the base of hemlock needles, the needles die when deprived of nutrients, and with reduced photosynthesis a tree will die within 5–15 years. When we sampled the Meeting House Brook hemlocks in 2016, I could tell that HWA was present as I saw its cottony white ovisacs clinging to the foliage on the bottoms of the branches of MHB-4, MHB-5, and other hemlocks in that stand.

MHB-4 hung on for around ten years, aided by occasional drops in HWA populations during cold winters. But the tree eventually succumbed, losing fine branches and bark as it died, leaving the skeletal form I would encounter on my recent visit to Meeting House Brook in June of 2023. Tragically, this will be the fate of hemlocks large and small throughout the Fells, including MHB-5, and eventually across the species’ entire range. Now is the time to learn as much as we can about the ecology of eastern hemlock, to delight in these wonderful trees while we still have the chance, and to honor them when they pass away. 🌿



# Standing Dead

By Galen Bunting

‘S tanding dead’ is the name for a plant no longer living, now dead, but still part of Arnold Arboretum’s collection. As a part of healthy forest ecosystems, these standing dead are self-supporting remnants of once-living trees. For insects, snags provide a source of nutrients, feeding on their decaying matter, while birds find important habitats inside their bark and among their branches.

On a cold, clear day in March, I walked Hemlock Hill in search of standing dead specimens. The first one I noticed was 1911-98\*A, a specimen of Canadian hemlock (*Tsuga canadensis*) tightly spaced with another living hemlock, their living and dead branches intertwining. The dead wood bore a healthy green hue, living things flourishing on its dead bark. So life visits the standing dead.

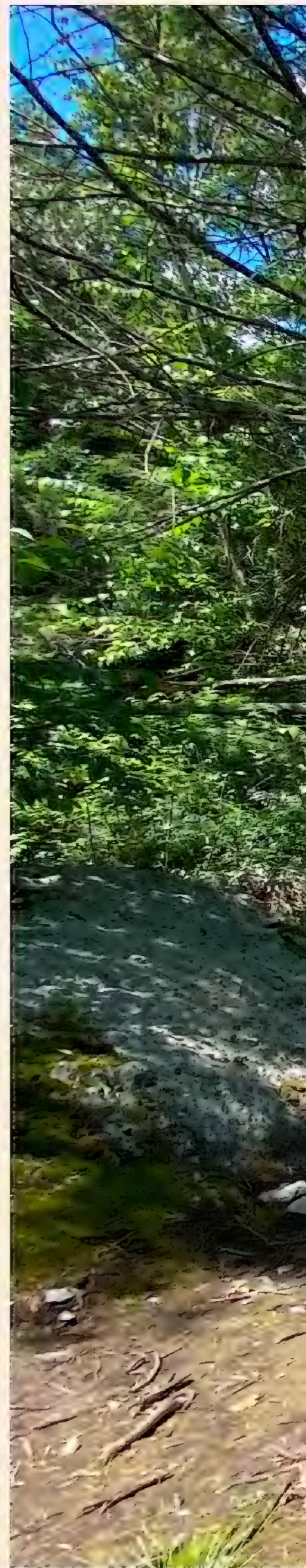
Farther up, past a rock outcropping, another hemlock snag (2341-98\*A) had progressed further in its decay. Bracket fungus and purple polypore carpeted its bark, marching up its deceased bole. Fruiting bodies of the fungal mycelium, these dispersal organs are chitinous, not plant material, erupting from darkness to seek light. They form a profuse fungal ladder up the sides of the snag, lacy outlines in stark contrast to the rough bark. In their plenitude, the many successful fruiting bodies provide a snapshot of the hyphal mass beneath the bark. This mass of life extends upwards, as tall as this hemlock once stood—a successful biological strategy. They spread their spores over Hemlock hill, near the summit, where the wind catches them and distributes them over snags and fallen dead.

The final member of the standing dead I encountered was barely standing at all. A stump sticks out near the summit of Hemlock Hill. In full sunlight, 1952-98\*A stands fully rotted from the base, colonized by mossy, mazy polypore. This fungus does not march up its sides, but layers the dead hemlock stump, demonstrating just how deeply this specimen has decayed.

The standing dead do not dazzle with their foliage, but they still contribute to the ecological circle of Hemlock Hill. Whether standing or fallen dead, these members of the collection at Arnold Arboretum are a home for new life, long after death. 🌿

**Galen Bunting** is a postdoctoral fellow in English at Northeastern University.

Snag of *Tsuga canadensis*, 2341-98\*A, on Hemlock Hill. Photograph by Matthew Battles





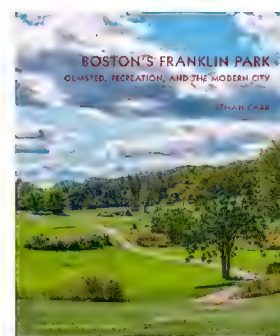




# The “Large Park” of the System

By Ethan Carr

By the summer of 1884, the visiting public was already engaged in patterns of uses and activities that would define the future park. In September the commissioners authorized Olmsted to produce a preliminary plan, and at the end of the year he reported his initial intentions. He wrote that the “prime object” of the park was to enhance, preserve, and make accessible “a body of rural and sylvan scenery, large in scale, simple and tranquil in character; and in contrast and as a foil to this, passages of a wild, rugged, picturesque and forest-like aspect.” With the right design, this could be done while also creating a “place of general congregations,” where carriages, horseback riders, and everyone else could all meet “without clashing” in the



Excerpted from  
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and the Modern  
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Visitors at the  
Ellicott Arch.  
Photograph by  
Millicent Harvey









“enjoyment of a gay throng.” The same was true for grounds “suitable for public festivities” of a wide variety, and extensive picnic areas, especially for those “unable to go out of town during the summer.” He also suggested that a suitable area of the park could be leased for the operation of a zoo. As long as these features were located and designed “without crippling the park for its main object,” a full range of activities and programs—as existed in Central Park and Prospect Park—could be achieved in an overall composition without sacrificing the rural character that was the landscape’s primary value.<sup>1</sup> In 1885 the park commissioners gave West Roxbury Park a new name: Franklin Park. Benjamin Franklin was honored because a bequest he made to the city was scheduled to mature in 1891, and they hoped the funds would be used to pay for construction.<sup>2</sup>

Olmsted often emphasized the degree to which the site of Franklin Park would be easily transformed into an ideal “large park” at low cost. The public’s enthusiastic and rapid adoption of the landscape confirmed its ready adaptability. By the 1880s, many park commissions knew that selecting an already scenic area for a large park reduced construction expenses. If they were not aware of it, Olmsted was always quick to make the point, since it was a good argument for selecting sites with maximum potential. For Olmsted, the design of large parks was a practice that had always involved preserving existing landscape character as much as developing new “effects,” or experiences. Making a park entailed doing more, or doing less, to achieve the same goals.

When he and Vaux had struggled with the notoriously unpropitious site for Central Park, extensive soil amendments and elaborate subsurface drainage systems were required in many areas, and innovative sunken transverse drives prevented the division of the landscape by the city’s street grid. The result was costly, reported by Olmsted to be \$14,000 per acre—the same cost as the heavily engineered Back Bay Fens. Prospect Park, where Olmsted and Vaux had more control of the boundaries of the area and less engineering was required, came in at \$9,000 per acre. The Brooklyn park nevertheless was considered by many the greater work of art because it achieved more expansive landscape effects—the Long Meadow and the Lake—than had been possible on the Manhattan site, which had been chosen for reasons other than its potential as an enhanced rural landscape.<sup>3</sup>

In 1885, Olmsted projected that the total cost of Franklin Park would be \$2,900 per acre. Certainly

the estimate was an economic argument for the desirability of the design he presented at that time, and no doubt it appealed to the always parsimonious Boston officials. But the estimate also quantified how much improvement would be required to realize the intended results on the site, and it indicated the degree to which the existing landscape suited its new purpose.<sup>4</sup>

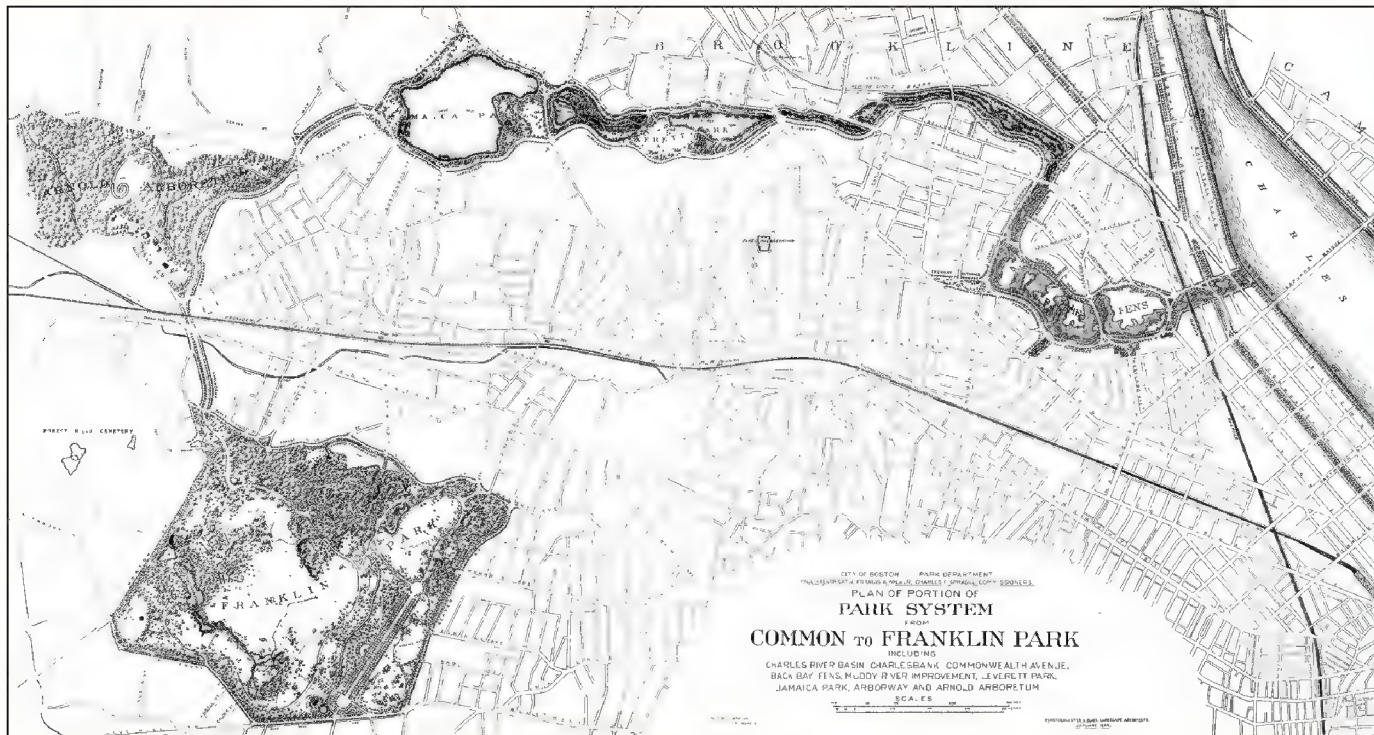
The amount of development needed to make a place a park was a function of the site’s character and condition, not just a question of saving money. In 1858, Olmsted and Vaux proposed that the north end of Central Park, which was a relatively undisturbed, wooded area, be “interfere[d] with” as little as possible: it already possessed a desirable “picturesque” character and required only the construction of the park drive, paths, and overlooks.<sup>5</sup> Most of the park budget was spent on the south end, where conditions demanded extensive improvements. In 1868, when Olmsted toured the proposed site of Delaware Park, the large park of the Buffalo system, he advised, “Here is your park, almost ready-made,” a reaction similar to what he expressed to Dalton in 1876.

Throughout his career, Olmsted based his designs of large parks on a response to the contingencies of the sites chosen for systems of public landscapes. While those choices were made by park commissions, Olmsted often had an advisory role, as he did in Boston. Park design involved devising the best response to the site—defined in both aesthetic and economic terms—whether it was a waterfall in western New York, a mountain in Montreal, or the pastures and wooded ledges of West Roxbury.<sup>6</sup> For Olmsted, no conflict existed between preserving the site of a large park and designing the roads, paths, and other features that allowed it to function and enhanced its enjoyment. When properly planned, such development was the means of preservation, since it choreographed public activities, mitigated their impact, and assured a constituency opposed to developing the area for other public or private purposes.

“The problem of a park,” Olmsted wrote in 1881, was “the reconciliation of adequate beauty of nature in scenery with adequate means in artificial constructions of protecting the conditions of such beauty, and holding it available to the use, in a convenient and orderly way, of those needing it.”<sup>7</sup> The results—large parks—were works of art, but none could be described as artificial constructions or objects, as in other artistic disciplines. Neither did Olmsted make a qualitative distinction between large urban parks and the



## The Language of Linked Landscapes



As Ethan Carr makes clear in the book excerpted here, Franklin Park is one of the crown jewels of the Emerald Necklace. Whence the necklace metaphor? Frederick Law Olmsted did not coin the term “Emerald Necklace”; for Olmsted and city officials, it was simply the Boston Park System. Some still-unknown person created the term sometime in the middle of the twentieth century. The resonance of that term, indicating landscapes linked by parkways, underscores Olmsted’s singular vision for the Boston Parks. The system became the necklace, and the necklace became a national metaphor for linked parks in Atlanta, Cleveland, Rochester, Milwaukee, Los Angeles, and other urban settings.

Olmsted’s skill in negotiating with the city while holding on to his principles gave Boston the great park system it has today, in the form of distinct spaces linked by parkways. Olmsted resisted calling most of the segments “parks,” a term suggesting traditional amenities that these spaces could not and should not provide. With the exception of Franklin Park, segments were named for their natural character: fens, river, kettle pond. In 1887, when pushed by the Boston Commissioners to add a distinctive name to the system as a whole, Olmsted suggested the term “Parkway.”

The idea of linked public landscapes did not originate with Olmsted, however. In 1855, the planners Horace William Shaler Cleveland and Robert Morris Copeland designed Sleepy Hollow Cemetery in Concord, Massachusetts as part of a system of public spaces. In 1927, the landscape architect Stephen Child referred to the Boston system as a “jeweled girdle . . . a regal adornment any city might proudly clasp around its throbbing, pulsing life.”

Carr shows us that park systems are dynamic; change is inherent. Olmsted’s plans and detailed narratives give contemporary landscape architects and community groups a road map to protect and enrich Boston’s Emerald Necklace.

*PHYLLIS ANDERSEN is a landscape historian and former director of the Institute of Cultural Landscape Studies of the Arnold Arboretum*





"Middlesex Fells," ca. 1903. *Library of Congress Geography and Map Division*

even larger "reservations," such as the Niagara State Reservation, that appeared outside cities beginning in the 1880s. The advice given, the design, might differ, but the purpose and goals remained constant: creating sustainable public landscapes, accessible to all, in which healthful experiences of landscape beauty and vital community socialization could occur.

Nowhere was this more evident than in the plans for new landscape reservations in municipalities outside of Boston. In 1879, as he completed the designs for the Back Bay Fens and the Arnold Arboretum, Olmsted went twelve miles north to Lynn, where citizens and officials were advocating for a "free public forest" that would become the Lynn Woods Reservation. The next year, the journalist and park advocate Sylvester Baxter asked him to advise on the creation of another reservation nearby, the Middlesex Fells. Both covered areas of more than two thousand acres and featured woodlands, ponds, and dramatic, glaciated geology. Olmsted advised that trying to make such landscapes "park-like" was hopeless and would be an expensive failure. The wooded, rocky sites should be taken for what they were, and their "natural characteristics" should be the basis of whatever limited improvements were required to make them

valuable retreats for nearby residents and for the people of the entire region. Forestry management that would "enlarge, strengthen, and emphasize a local character" should be the first priority. Minimal "roads and walks, bridges, shelters and other constructions" could be quickly built (later) and should not attempt the degree of "finish" appropriate for many urban parks.<sup>8</sup>

The expansion of park planning to the regional scale, however, would primarily be the work of Charles Eliot (1859–1897), who joined the firm as an apprentice in 1883. Eliot worked closely with Olmsted for two years and participated in early investigations and preliminary designs for Franklin Park. He went on to start his own office in 1886, eventually returning to Fairsted as a partner in 1893. Well-connected socially and politically, Eliot in 1889 suggested the creation of the first land trust: a nonprofit and tax-free organization that could receive gifts of land to hold in trust for the benefit of the public. The state passed legislation to form The Trustees of Public Reservations in 1891, and Eliot was named chair of the standing governing committee.

Working with Sylvester Baxter, Eliot also lobbied for a "metropolitan" park commission. Established



For Olmsted, the design of large parks was a practice that had always involved preserving existing landscape character as much as developing new “effects,” or experiences.

in 1892, it was the first regional park commission of its type, and Eliot was named consulting landscape architect. Until his death in 1897 at the age of thirty-eight, he oversaw the acquisition and development of more than nine thousand acres of parks—a collection of regional landscape types, including beaches, estuaries, forests, and characteristic geological formations—in thirty-seven separate municipalities around Boston. The Blue Hills (the background of several views in Franklin Park) became one of the first reservations created in 1893, along with the Middlesex Fells, Waverly Oaks (Beaver Brook), and Stony Brook reservations. In 1890, Eliot expressed goals for these regional parks that echoed Olmsted’s for Franklin Park: “A crowded population thirsts, occasionally at least, for the sight of something very different from the public garden, square, or ball-field. The railroads and new electric street railways which radiate from the Hub carry many thousands every pleasant Sunday through the suburbs to the real country ... for the sake of the refreshment ... the country brings to them.”<sup>9</sup>

Olmsted had increasingly emphasized doing less and relying more on the character of the site to produce a composition of landscape effects, culminating

in his design for his last great park. Eliot took the next step, emphasizing to an even greater degree the preservation of existing features and distinctive qualities of a landscape. Writing about the metropolitan reservations shortly before he died, he predicted that “it is ... quite unlikely that there will ever be any need of artificially modifying them to any considerable degree. Such paths or roads as will be needed to make the scenery accessible will be mere slender threads of graded surface winding over and among the huge natural forms of the ground.”<sup>10</sup> For Olmsted, both park systems were a single, integrated project: urban landscape planning extended into regional landscape planning. Both could be structured by siting and designing a range of public landscapes serving multiple functions and purposes. In 1893 he wrote to his stepson, J. C. Olmsted, and Eliot (both now his partners):

Our reputation is still to be made ... in such “wild” public grounds, as those that we are now first to engage with about Boston. As much is to be made in this respect, as was to be made in Central Park. In your probable life-time, Muddy River, Blue Hills, the Fells, Waverly Oaks, Charles River and Beaches, will be points to date from in the history of American Landscape Architecture, as much as Central Park.





Boylston Street Bridge, Back Bay Fens. *Detroit Publishing Co., Library of Congress Prints and Photographs Division*

They will be the opening of new Chapters of the Art. And there will be fashions starting from them, which will run across the Continent.<sup>11</sup>

This would in fact be the case. Over the next fifty years regional, county, and state park commissions proliferated. The national parks coalesced and expanded into a system after Congress created the National Park Service in 1916. Almost all of these new park agencies hired landscape architects to plan and design their parks. Through the 1920s and 1930s, their work continued and elaborated on a practice of large-park making that had germinated at Fairsted and taken root through the experience of creating Franklin Park and the metropolitan reservations around Boston.<sup>12</sup>

Franklin Park looked two ways: back to the municipal large parks of previous decades and forward to the regional reservations, state parks, and national parks that were to come. This perspective is especially evident in the design of the landscape structures and buildings in the park, which showed the results of a rich period of innovation by Olmsted and his collaborators in the early 1880s. Preeminent among these was H. H. Richardson. In the 1870s the

two had worked together on the Buffalo State Hospital for the Insane, the New York State Capitol, and other projects. Following the 1877 completion of his Trinity Church in Boston, Richardson was one of the most influential architects in the country.

In 1880, Olmsted asked him to design the Boylston Street Bridge as part of the Back Bay Fens landscape. The bridge formed a major portal into the Fens, while carrying intersecting traffic over the park. Richardson designed an undulating mass of irregular ashlar masonry inspired by the surrounding landscape forms and geology and devoid of historical details or ornamentation. The architect understood that Olmsted rejected the gardenesque displays of, for example, the Public Garden, and produced an architectural idiom consistent with the overall evocation of a tidal estuary. Both designers moved beyond stylistic eclecticism to produce an integration of landscape and architecture rooted in an organic, geologic aesthetic. The architectural historian James F. O’Gorman describes the bridge as a “complete collaboration between architect and landscape architect, between man and nature, between architecture and geology.”<sup>13</sup>

This was a new type of park architecture that differed significantly from most of that found in





North Easton Memorial Cairn. *Frederick Law Olmsted National Historic Site*

Olmsted's earlier parks. For Central Park and Prospect Park, Calvert Vaux had provided playful and diverse bridges and other structures, usually in the popular Gothic Revival or another historical style. The architect Thomas Wisedell later worked with Olmsted in a similar vein for the structures of the U.S. Capitol grounds and other projects. But the collaboration with Richardson was profoundly and mutually influential in ways these earlier partnerships had not been. The Adirondack-inspired "rustic" structures of the Ramble and the north end of Central Park did feature rough stone construction and unfinished materials, and they were one inspiration for the direction Olmsted and Richardson took in the 1880s.<sup>14</sup> But these examples were mostly limited to the wilder areas of the New York (and other) parks, and were part of an overall eclecticism in park architecture.

The boulder masonry buildings and structures that Olmsted designed in the early 1880s constituted an original and distinctive style, one that he employed throughout the Boston parks and in a number of other public and private commissions immediately before he began the design of Franklin Park. Many of these projects were in collaboration with Richardson, notably for the Ames family in North

Easton, Massachusetts. The art critic and Richardson biographer Mariana Griswold Van Rensselaer noted the significance of their mutual artistic influence during this period, for example, in the design of the Memorial Hall in North Easton. Richardson used the rocky site of the building to advantage, she observed, and Olmsted's surrounding landscape enhanced the effect. The granite formations of the site were employed as design elements, and "the tower of the hall [rose] out of the rock, almost like a natural development."<sup>15</sup> Richardson, however, died at the age of forty-seven in 1886, leaving Olmsted to work with other amenable architects, such as Richardson's successors at Shepley, Rutan & Coolidge and the firm Peabody & Stearns. But the Fairsted office also developed its own architectural design capacity, and the most important building in Franklin Park, the Overlook Shelter, would be designed by Olmsted himself.

As Olmsted prepared the plan of Franklin Park beginning in 1884, another important collaborator helped shape the distinctive architecture being developed. From the beginning, Olmsted wanted rough-boulder masonry construction for structures in the Boston parks (although for the Boylston Street Bridge he and Richardson acquiesced to granite





Ellicott Arch, rough perspective sketch, 1888. *Frederick Law Olmsted National Historic Site*

ashlar). John H. Watson worked with him to develop the materials and techniques to realize this goal. Watson was a mason from Salem who specialized in rough-boulder retaining walls and other structures. He built the stone grotto on the U.S. Capitol Grounds in 1879 and the boulder retaining wall and terrace for the John C. Phillips estate (Moraine Farm) in Beverly, Massachusetts, the following year. It was Watson who constructed the remarkable Civil War memorial cairn and terrace in front of the North Easton Memorial Hall in 1882, and he worked on a number of Olmsted's projects of the period.<sup>16</sup> Watson would also build many of the landscape structures and site furniture in Franklin Park.<sup>17</sup>

Olmsted's approach to the design of Franklin Park's structures, shaped by his preceding collaborative innovations, was a distinctly new park architecture, one that would employ organic flowing forms, boulder masonry, and complete integration with the materials and structure of the landscape. The buildings, site details, and furniture of Franklin Park became influential precedents for how necessary construction in a large park could be unified with the intent and appearance of the landscape design—and left behind the eclectic (if delightful) Victorian

confections of Vaux and Wisedell. This development in park architecture would not, however, primarily influence municipal parks. Fewer cities would continue to plan large urban parks in the coming decades. But regional authorities, counties, states, and the federal government were embarking on an intense period of park and park system development.

Many of these parks—or reservations—were indeed large. And many would employ boulder construction, local materials, and careful integration with sites in their development. By the 1920s, the National Park Service enshrined such work as “rustic” park architecture. The origins of this distinctive and pervasive style are to be found in Franklin Park. Olmsted's last great municipal park prefigured the future of large parks, which would now more often be created in suburban, rural, and wilderness areas. But in the design of their structures—from buildings to roadsides, overlooks, and campgrounds—their lineage reaches back to Olmsted's urban park design of the 1880s. 🌿

ETHAN CARR *Ph.D., FASLA*, is a professor of landscape architecture at the University of Massachusetts, Amherst. *Boston's Franklin Park: Olmsted, Recreation, and the Modern City* will be available this fall.





Bench on the Overlook Terrace, Franklin Park, 1890s. *Frederick Law Olmsted National Historic Site*

#### END NOTES

1. Tenth Annual Report, 18–19.
2. Eleventh Annual Report of the Board of Park Commissioners [1885] (Boston, 1886), 20–24. The Franklin bequest was never used for the park. In 1908 the funds were used to establish a technical school, the Franklin Union. Richard Heath, “Franklin Park Notes,” *Jamaica Plain Citizen*, January 29, 1981, 8.
3. Many interests were involved in choosing the Central Park site. See Roy Rosenzweig and Elizabeth Blackmar, *The Park and the People: A History of Central Park* (Ithaca: Cornell University Press, 1992), 37–58.
4. The estimate included the costs of land, development, and maintenance as of 1885 and were included in Olmsted’s report accompanying his plan submitted to the park commissioners that year. FLO, “Notes on the Plan,” 507.
5. FLO and Calvert Vaux, “Greensward” [1858], PFLO 3: 119–87, quot. 119.
6. In 1869, while working in Buffalo, Olmsted led a campaign to preserve nearby Niagara Falls, and he and Vaux later completed the design for the Niagara State Reservation. Francis R. Kowsky, *The Best Planned City in the World: Olmsted, Vaux, and the Buffalo Park System* (Amherst: University of Massachusetts Press / LALH, 2013), 33, 158–71. In 1874, when asked by the City of Montreal to make a park out of the mountain that rose up near the center of the island on which the city stood, Olmsted noted that a 700-foot-high formation of igneous rock was not suitable for a “park,” at least not the type of landscape he felt that word implied. He wrote in the report accompanying his 1881 plan: “It would be wasteful to try to make anything else but a mountain out of it; equally wasteful to attempt anything that would involve a loss of such advantages as it has for this purpose.” FLO to the Commissioners of Mount Royal Park, November 21, 1875, PFLO 7: 84–91; FLO, “Mount Royal” [1881], PFLO SS1: 350–418, quot. 379.
7. FLO, “A Consideration of the Justifying Value of a Public Park,” January 28, 1881, PFLO SS1: 331–49.
8. FLO to Sylvester Baxter, November 9, 1880, PFLO 7: 510–12, and August 20, 1889, PFLO 8: 721–23; FLO to Phillip A. Chase, November 29, 1889, PFLO 8: 752–55.
9. PFLO 9: 70–72; Charles W. Eliot, in *Charles Eliot, Landscape Architect* [1902], ed. Keith N. Morgan (Amherst: University of Massachusetts Press with LALH, 1999), 317.
10. Charles Eliot, *Vegetation and Scenery in the Metropolitan Reservations of Boston* (Boston: Lamson, Wolfe, 1898), 7.
11. FLO to John Charles Olmsted and Charles Eliot, November 1, 1893, PFLO 9: 700–709.
12. See Ethan Carr, *Wilderness by Design: Landscape Architecture and the National Park Service* (Lincoln: University of Nebraska Press, 1998), 95–109.
13. James F. O’Gorman, *Living Architecture: A Biography of H. H. Richardson* (New York: Simon & Schuster, 1997), 133.
14. See Frank R. Kowsky, “The Veil of Nature: H. H. Richardson and Frederick Law Olmsted,” in *H. H. Richardson: The Architect, His Peers, and Their Era*, ed. Maureen Meister (Cambridge: MIT Press, 1999): 55–75.
15. Mariana Griswold Van Rensselaer, *Henry Hobson Richardson and His Works* (1888; reprint, New York: Dover, 1969), 71.
16. See FLO to Oakes Angier Ames [April 1882], PFLO 8: 50–54.
17. PFLO 8: 203n6.



# The Hopeful Monsters of Skåne

By Rob Nicholson

*It may perhaps be doubted whether monstrosities, or such sudden and great deviations of structure as we occasionally see in our domestic productions, more especially with plants, are ever permanently propagated in a state of nature.*

—Charles Darwin, *On the Origin of Species*

Darwin and most of his peers had no conception of what we now know as genetics, the biological processes that determine how traits get inherited and expressed in progeny, and how mutations occur. It wasn't until the time of Hugo DeVries (1848–1935), who coined the word “gene” before learning of Gregor Mendel's pioneering work on heredity, that the term “mutation” came to be applied toward biological entities, and the phenomenon it names seen as a possible driver of evolutionary change. Darwin and his peers did recognize sudden changes to a species' appearance, which they called “spontaneous variations,” “sports,” and “monstrosities.” There were vigorous debates over the rate of biological change to species, with Darwin arguing for gradual change, stating, *Natura non facit saltum*: “Nature does not jump.” De Vries and others, however, advocated that sudden shifts in species could occur. The German geneticist Richard Goldschmidt took up this argument in his book, *The Material Basis of Evolution* (1940), asserting that “the change from species to species is not a change involving more and more additional atomistic changes, but a complete change of the primary pattern or reaction system into a new one.” He came up with the colorful term “hopeful monsters” to describe these sudden shifts in the genome.

As a walk through most any garden center will suggest, the field of horticulture is a parade of hybrids and mutations: larger flowers, abnormal colors, multi-colored leaves, atypical habits, and on and on. As a member of the propagation staff at the Arnold's Dana Greenhouses long ago, I found it impossible not to be attuned to mutations. Not only did we propagate atypical forms from the collection as grafts or cuttings, but we were always on the lookout for an aberration in a flat of seedlings to isolate and grow on. The Arnold rightly shifted away from horticultural selections to wild-collected material; but commercial, corporate horticulture remains largely a catwalk sashay of this year's “hopeful monsters.”

A multigenerational portrait of humans and trees: the author and his son, Charlie, documenting the monstrous forms exhibited by the *Fagus sylvatica* ‘Tortuosa’ of Skåne. *Courtesy of the author*







In doing fieldwork for the Arnold, I would occasionally spot mutations in nature—a variegated branch on a *Chamaecyparis thyoides* at Ponkapog Pond in Milton, Massachusetts; witches brooms on the occasional conifer. As Darwin suggests, however, these generally are rare, and need a keen eye to spot. I have never been in a forest where a mutation presents itself so dramatically and with such frequency as the beech forests in the southernmost län (county) of Skåne in Sweden. There, the tortured or parasol beech, *Fagus sylvatica* ‘Tortuosa’, stuns the eye and challenges the mind.

## The European Beech

The species *Fagus sylvatica*, the European beech, has a very wide range in Europe, from the Cantabrian Mountains of Spain to the Carpathians and Balkans of eastern Europe, and from Sicily north to southern Sweden and Norway. The few Norwegian stands have been shown to be genetically connected to Danish populations, and are now thought to have been transported by human agency long ago, possibly as pannage for pigs on Viking ships.

Under the right conditions, the European beech can attain massive size, as much as fifty meters tall with girths up to eight meters. The altitudinal range of the species can be as high as two thousand meters in Spain and Sicily, to low coastal altitudes in the northern parts of the range.

There are about sixty named horticultural selections or cultivars of European beech: fastigiate, weeping, red leafed, tricolor leafed, fern leafed and on and on. But none, to me, match the mysterious tortured beech, *Fagus sylvatica* ‘Tortuosa’.

I first came across this tree in 1977 while cross country skiing through the Arnold Arboretum on a snowy winter day. I slid downslope into the magnificent beech collection and was astounded at the site of the tortured beech. In 1996, I wrote about this astonishing sight in the June issue of *Natural History Magazine*:

Standing only twenty feet high after one hundred years, this tree surely has battled for every inch, rising from a splay of roots, its trunk is a curving, silvery gray column, encrusted with knobs, warts, and carbuncles. The lower branches have grown out, contorting backward and grafting themselves into the trunk to form odd cup handles, or “horse collars.” Clusters of main branches writhe upward, then branchlets zigzag down to the ground. The crown forms a dome of serpentine branches, a

parasol fit to shade a Mad Hatter’s tea party. Where the bark has fallen off, the contorted growth pattern of the wood is exposed; it looks more like tightly folded igneous rock than wood. This tree is botanical chaos, Quasimodo in wood.

A picturesque dusting of snow only highlighted the crazed architecture. It instantly became, and remains, my favorite tree in the collection. But what was the origin story of this fantastic beast?

The earliest written report of these curious trees, from Denmark, dates from the 1840s. The French botanist Pierre Denis Pépin was the first to apply the ‘Tortuosa’ epithet in 1861, beginning a long line of French botanists who wrote about the twisted trees of the Verzy forest in northeast France, perhaps the most famous stand. Élie Abel Carrière in 1864 described the trees as “a riddle to the scholars, a challenge to all plant theories.” He offered up my favorite description of the otherworldly mutants: “imagine a number of snakes in a bag, and then imagine hitting the bag with a stick; the reptiles would contort themselves in such a way that all the individual forms would join in a hideous and bizarre group. Such is more or less the general form that the monster beech trees of Verzy exhibit at the point where they branch out.”

Large clusters of the tortured beech have been recorded in forests in six countries. Within northeast France, Parent notes over eight hundred specimens of “Faux de Verzy” in an area 100 by 250 kilometers, concentrated mainly around Verzy; In the Sjaelland (Zealand) region of Denmark, “Vrange bøge” (twisted beech) also are found; the Weserbergland in Lower Saxony (North Central Germany) hosts some four hundred wild trees of “Süntel-Buchen”; and in Sweden, near Dalby in Skåne, about 1100 trees of “Vresbok” have been recently inventoried. Additional smaller groups have been documented from Mt. Pollino in Italy (“Alberi serpente”), and 40 specimens of “Vilina bukva” at Batočići in Bosnia and Herzegovina.

Since that snowy day in 1977, the tortured beech had been on the wish-list of trees I planned to see in their wild state. My chance came about when I undertook a plant-collecting trip to Norway and Sweden in 1993 for the purpose of collecting wild English yew (*Taxus baccata*) for anti-cancer research. I contacted an old and respected friend, Karl Flinck, a former business executive and self-taught dendrologist, who nurtured his own private arboretum in southern Sweden. I wrote of my intent to visit Scandinavia and, if time allowed, to visit the grove of beech at Verzy, France.



The path wound under the old,  
contorted canopies, which stood  
like so many frozen snakes writhing  
above our heads.

He wrote back with an invitation, thrilling me with the news that a grove of monster beeches was but an hour's drive south of him. With my four-year-old son in tow, we visited Karl and then the trees near Dalby, photographing about a dozen.

Little could I have known that thirty years later, my son would be a postdoc at Lund University in Sweden and, joined by my wife and his mother, Ida Hay, we would make the trip again, visiting Skåne twice between 2022 and 2023. When Charlie and I had visited Karl Flinck long ago, the four-year-old Charlie absolutely charmed our host when he said, "you know, I think Karl is a man of nature." It was nice to see that my son, a specialist in pollination ecology, had grown to be the same. I had hoped that my Charlie's new son Cyrus would join to make the first foray a three-generation affair, but he was not quite forest-ready. As a one-year-old, my grandson did make the cut on our most recent visit to the forest, however, foreshadowing another generation keeping company with the natural world (when not fast asleep).

### **A Walk with Trolls**

After two bus rides from Malmö, we disembarked at the village of Torna Hällestad and walked down Trollskogsvägen (Troll Road) toward the nature

preserves that held the trees. Following a trail that paralleled the railroad tracks before cutting across some open fields, we passed through a livestock fence and crossed into the Prästaskogen nature reserve, then up onto a glacial moraine, getting into forest. Our initial tree with contorted branches had a normal trunk and thus was, as we would soon find, an intermediate form. We continued along the ridge path and soon were awed by a succession of tortured beeches. Each was different, varying degrees and styles of contortedness and different ages. Some were sixty feet tall, bent branches atop a fairly straight trunk, while others grew contorted from the ground up. You could pick out mutated saplings from normal young beeches, as the mutation expresses at an early age. Individual tortured beeches punctuated the slope of normal trees, but also appeared in picturesque clusters. The path wound under the old, contorted canopies, which stood like so many frozen snakes writhing above our heads. One extreme tree stretched a remarkably massive and twisted branch across the path, a writhing, wooden anaconda you had to duck under to pass. After a lifetime of collecting "normal" trees in the forests of the world, I had never seen anything like it. The presence of non-mutated beeches all around only increased the sense of right and wrong.





On the path in the Prästaskogen nature preserve outside Torna Hällestad. *Courtesy of the author*

We cut off the path toward the light of an open field, at the edge of which stood a tortured beech dense with three-angled, spiny nuts—so tempting to collect, though I had no permits, and had to pass. The full sun exposure seemed to bring greater fruit set and tighter branching. Turning downslope, we crossed a shrubby meadow, seeing old friends like *Euonymus alatus*, *Symphoricarpos albus* (non-native), and *Calluna vulgaris*. We climbed another livestock fence and were immediately in another grove, called by locals *Trollskogen*, the Enchanted Forest. This proved to be a denser concentration of trees spread over several acres with some spectacular groupings of twisting, convoluted trunks and branches. Local people once believed these trees to be trolls, who were either cursed into their current form or could transform back into their original bodies at night. Dozens of the wooden monstrosities presented themselves, each unique in form and genetics. It struck me as improbable that this perfect set for movies with hobbits, witches, vampires, and trolls had never found its way onto the screen.

Alongside the road, as if planted together, a cluster of four trunks stood twisted about each other—sculptural, mystic, almost beyond description, another clan of dancing arboreal dragons. We continued up

the Trollskogsvägen to Gryteskogen, another dense cluster of *Fagus sylvatica* ‘Tortuosa’, where we found one specimen that showed a “horse collar” growth: a branch that had extended out, contorted back to the trunk, and grafted itself on, forming a crazed teacup handle that *could* catch a horse’s head. It *did* catch a few botanists that day. After passing through a mossy fieldstone wall that reminded us of New England, we came upon a final large, magnificent specimen.

All told, we probably saw a hundred contorted beeches in a few hours, and by no means saw them all. A great day in the forest was only made better at a bus stop cafe, with its pastries and dark-roast coffee. Between sips, it occurred to me how many versions of the mutation we saw, all different and unique. I had propagated many plants of the Arnold’s tree via grafting (a thirty-year-old specimen grows in the backyard of my Boston house), but I now realized what a small fraction of the total story the Arnold’s two trees represented. It is like a one-inch square snipped from a vast canvas by Monet.

### Cause and Effect

Prior to botanists trying to explain the trees, local peoples would attribute religious, mystical, or





Distribution of known major wild populations of *Fagus sylvatica* 'Tortuosa' in Europe. Map by Kyle Port

mythological reasons for the twisting growth; my favorite name for a tree, in German, which translates to “Devil’s Pulpit,” bears this out. French botanists theorizing about cause prior to the advent of genetic theory suggested that the iron soils of the region of Verzy caused the deformity. In 1906, Henry James Elwes and Augustine Henry discussed the tortured beech in their classic tome, *The Trees of Great Britain and Ireland*. Their section on the tree sounds a decidedly genetic note: “fruits of this form have been sown in the garden of the Forest School of Nancy, and have reproduced the twisted form in the proportion of three-fifths; the other two-fifths of the fruit produced form like the common beech and intermediate varieties.” Thus Elwes and Henry observe the heritability of the mutation, further noting that only three-fifths of the offspring exhibit the tortuous form—as we understand now, evidence of genetic mutation. Later researchers have found the mutation in 25 to 100 percent of seed sown from ‘Tortuosa’.

Historically, then, the form of tortured beeches has been chalked up to soil composition and heritability. But my favorite theory of environmental causation involves extraterrestrial forces. As Anthony Huxley

observes in his book *Plant and Planet* (1974), “it is known that artificial radiation will produce mutations ...

One of the most remarkable examples of this is the tortuous beech of Europe. In these trees the branches writhe like serpents, often rejoining the trunk or other branches. All are about the same age; and they exist in Denmark, Germany, northern France, and Brittany, mainly in small numbers within an assemblage of normal trees. The remarkable thing is the localities are in a straight line, and one implication is that a radioactive meteorite passing over these places a century ago affected young trees immediately below it.

While I love the comic book premise, and the stands in northern Europe *are* in a roughly straight line, Huxley conveniently omitted (or didn’t know about) those stands in Italy and eastern Europe that aren’t on his meteoric line. But could the cause have another vector—a genetic chromosomal mutation passed along through pollen and seed, or perhaps a virus, which can also pass through seed?

Trees with mutated or abnormal habits differ chiefly in a lack of leader formation (forming



As the monster beech's branches grow, the signals to produce the correct mix of hormones seems to vary, switching on and off, resulting in a kind of arboreal schizophrenia.

Arnoldia | Fall 2023



Trees in the Trollskogen or Enchanted Forest tower overhead (above); younger specimens show how early the mutation expresses itself (top right); “dozens of the wooden monstrosities presented themselves” (bottom right), “each unique in form and genetics.” *Photographs courtesy of the author*

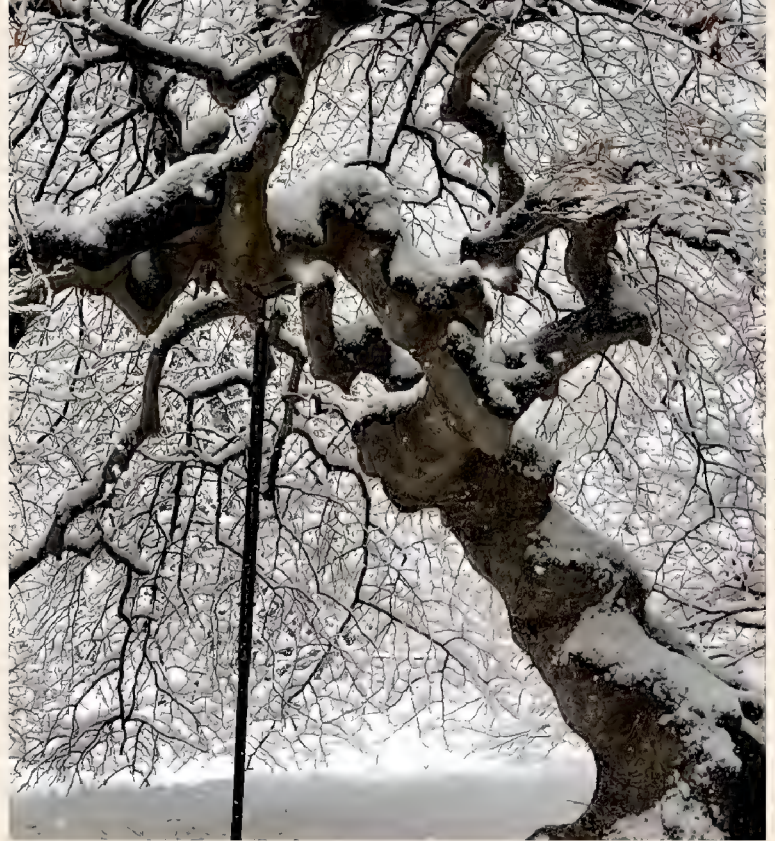






prostrate or weeping trees), reduced length between buds (dwarfism), or having side branches that are at a reduced angle to the vertical trunk (columnar). The side branches of non-tortured beeches grow from the trunk within a well-defined angular range; reaching upward at first, these branches may bend into downward growth as they lengthen and put on weight. In ‘Tortuosa’, the side branches do not show any recognizable pattern of growth, but operate under a different set of controls. When I first wrote about the tortured beech in the ‘90s, we knew much about the factors that could induce such aberrant growth through these hormones and other chemical growth regulators: Indole acetic acid (IAA), a simple hormone with far-reaching effects, stimulating cell division and differentiation and shoot elongation, originating in the stem tip and leaves, and moving downward through the stem; gibberellic acid, which promotes cell elongation; cytokinins, which also stimulate cell division; and ethylene. These and other compounds combine to produce a range of effects on growth and the formation of wood in the branches of a tree. In most trees, these effects are generally well-regulated. But as the monster beech’s branches grow, the signals to produce the correct mix of hormones seems to vary, switching on and off, resulting in a kind of arboreal schizophrenia. That this outcome has a genetic basis is evidenced by the prevalence of twisted growth even in seedlings, suggesting that these aberrant signals are hereditary. Disease, too, can affect hormone levels; IAA in particular can show increases, and symptoms such as epinasty (downward curving stems) and changed growth rate and form can result. Both bacterial and viral pathogens can skew hormonal balance, the effects of which can be carried along into seed and expressed in the resulting seedlings.

A recent theory, advanced by French researcher Jacques Bierne in 2017, suggests a transposon was involved within the beech itself. Transposons (jumping genes) are sections of chromosomes that can move from one location on the genome to another. Noting that some tortured beeches in France would throw off sections of new growth with normal branching architecture, a *retromutation*, Bierne concluded the ability of the contorted branch mutation/architecture to undergo a reversion again, back to normal growth, validated his theory that “the mutation of the gene involved is attributable to the mobility of a transposon.” I have seen dwarf Alberta spruces and other dwarf conifer mutations do a similar shift



14599\*A PHOTO BY WILLIAM (NED) FRIEDMAN

## Bottlenecks

“Genetic bottleneck” is a term for an environmental effect or human act that results in reduction of genetic diversity in a population, leaving the recovered community highly reduced in diversity. It could be said that the Arnold Arboretum has had more bottlenecks than a recycling center, and *Fagus sylvatica* ‘Tortuosa’ is a perfect example. The record of introduction of this taxon into our country is a little fuzzy. Early accounts of *Fagus sylvatica* in the United States include Andrew Jackson Downing’s book, *A Treatise on the Theory and Practice of Landscape Gardening, Adapted to North America* (1841). Though he discusses European beech and various selections such as the red leafed form and weeping form, he makes no mention of the monster beech. The Arnold Arboretum’s database shows it importing the tree three times from Kew Gardens in the UK between 1885 to 1888, and once from Simon-Louis Freres Nursery of Metz, France in 1888. The database has the Kew trees coming from Verzy, and two of these original four introductions survive, both from Kew (it is unclear if all three shipments from Kew were from a single source plant). From the Arnold’s introduction, other botanic gardens and nurseries would obtain scion wood and over many generations the tortured beech became established in American horticulture. I could find no records of importation other than the Arnold’s. While thousands of wild plants of this form exist in European forests and, I would suspect, as multiple clones in European gardens, those plants in the US may represent one to four clones from France. It would be a fascinating genetic study to compare specimens of the *Fagus sylvatica* ‘Tortuosa’ growing in U.S. and European gardens to determine just how narrow the bottleneck is.



to normal growth, so perhaps this theory applies to other taxa as well.

Perhaps the most confounding mystery within the tortured beech saga is that I saw a few specimens of tortured *oak* next to the beeches in Skåne; such oaks are also known from Verzy. No hybrids between *Fagus* and *Quercus* have been seen, though they are in the same family and frequently are found together in the wild. Neither are there cultivated selections of contorted oak, though “curly oaks” are noted in some places in Europe. This might point to a common external causality—perhaps an organism that can both infect and mutate both genera. Or—though a long shot—might this be an example of horizontal transposon transfer (HTT), in which a transposon (the section of genetic material containing the mutation) is transferred via microorganism, pollen, or root-to-root contact, from the beeches to the oaks?

To walk in a beech forest punctuated with mutations gives rise to the feeling we are all just temporary and fragile assemblages of genes, flowing through space and time. Had Darwin walked through this very forest, how might it have changed his views on “spontaneous variations” and “monstrosities” in nature? My own multiple visits to this remarkable forest of mutants brought out both the artist in me (how do you photograph them to best effect?) and the scientist (what has been written in past, what are the current theories, and what remains to be researched?). What began as a chance encounter in the snowy Arnold became a decades long hunt for *plants and answers*. I have little doubt that future researchers with new methodologies will return to these hopeful monsters to make new discoveries. Carrière’s words of 1864 still ring true: “a riddle to the scholars, a challenge to all plant theories.” 🌿

ROB NICHOLSON worked for three New England botanic gardens, undertaking over thirty plant collecting expeditions for collections building, conservation, and medical and botanical research, and making 1,920 wild collections for the Arnold Arboretum.

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FROM THE ROOTS

# Not the Nation, But the Forest State

By Sumana Roy

I'd like to begin by asking you to imagine what the history of your country might have been had it not been a nation but a forest state. Would it have been a democracy, a republic, a monarchy? More than a hundred years ago, writers and thinkers in colonial Bengal were imagining a forest state.

Rabindranath Tagore's understanding of his own culture—and indeed of his own consciousness—was mediated through a belief in the Indian subcontinent as being a “vast land of forests,” or even a large forest. It might have come to him from having been raised on an Upanishadic way of thinking, it might have also seeped into him and others from literature, both classical and colloquial. Here, for instance, is Bana Bhatta, his name *bana* meaning forest, in *Kadambari*: “The forest seems at times and at places to flaunt the trappings of a sovereign state as it were, as its herds of deer wave their *chamaras* or bushy tails, and

Rama, Sita, and  
Lakshmana at the  
Hermitage of Bharadvaja.  
India (Kangra, Himachal  
Pradesh), ca. 1780.  
*Metropolitan Museum  
of Art, 1976.15*



bands of wild elephants circle around, the one an insignia of royal power and the other an arm of the defence force.” And here is Rabindranath (in Bengal, we refer to our writers and artists by their first names, not necessarily their surnames): “When the first Aryan invaders appeared in India it was a vast land of forests ...

These forests afforded them shelter from the fierce heat of the sun and the ravages of tropical storms, pastures for cattle, fuel for sacrificial fire, and materials for building cottages. And the different Aryan clans with their patriarchal heads settled in the different forest tracts which had some special advantage of natural protection, and food and water in plenty. Thus in India it was in the forests that our civilization had its birth, and it took a distinct character from this origin and environment.

The passage is from *Sadhana: The Realisation of Life*, published in 1913, the year in which Rabindranath became the first Asian to be awarded the Nobel Prize.

What does it imply, when one sees an entire civilization as having originated in a forest? What makes it different from a civilization that, for instance, is biblically said to have found its birth in a garden, as the civilizational culture of India’s colonizer had? Or one that derives from the sea, which Rabindranath posits as the origin of European culture:

The history of the Northmen of Europe is resonant with the music of the sea. That sea is not merely topographical in its significance, but represents certain ideals of life which still guide the history and inspire the creations of that race. In the sea, nature presented herself to those men in her aspect of a danger, a barrier which seemed to be at constant war with the land and its children. The sea was the challenge of untamed nature to the indomitable human soul. And man did not flinch; he fought and won, and the spirit of fight continued in him. This fight he still maintains; it is the fight against disease and poverty, tyranny of matter and of man.

This refers to a people who live by the sea, and ride on it as on a wild, champing horse, catching it by its mane and making it render service from shore to shore. They find delight in turning by force the antagonism of circumstances into obedience. Truth appears to them in her aspect of dualism, the perpetual conflict of good and evil, which

has no reconciliation, which can only end in victory or defeat.

India’s culture of leisure, of rest, of optimism, of a natural cosmopolitanism that comes from the accommodativeness of the forest, where there is room for everyone, where no one is rejected, and of *ananda*, a spirit of joy, pleasure, happiness, contentment, and life-lovingness that Rabindranath understands as genetic to this place and its people, is a gift of forest living.

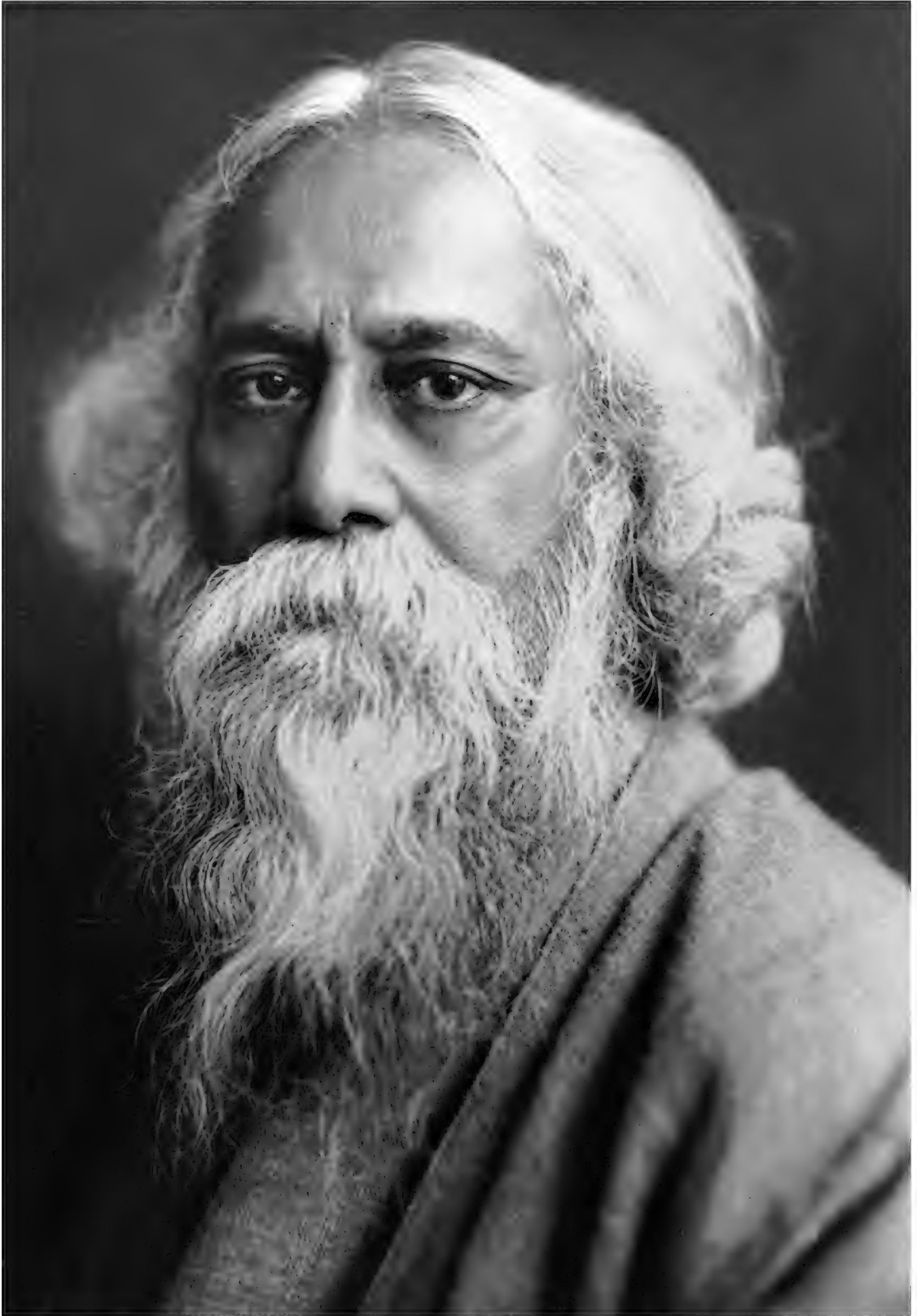
(I)n the level tracts of Northern India men found no barrier between their lives and the grand life that permeates the universe. The forest entered into a close relationship with their work and leisure, with their daily necessities and contemplations. They could not think of other surroundings as separate or inimical. So the view of the truth, which these men found, did not make manifest the difference, but rather the unity of all things. They uttered their faith in these words: *Yadidam kinch sarvam prana ejati nihsratam* (All that is vibrates with life, having come out from life).

This understanding of life, which Rabindranath imports naturally from Upanishadic texts, is a challenge to the European post-Renaissance anthropocentric understanding of life—man is not at the center; he is, like all other forms of the living, only a manifestation of life, he is merely one of many, none of whom are rejected by the structure of the forest, and, by metaphorical implication, by the political state.

We are given an unexpected interpretation of a model of monarchy, where the king must find their way through a forest—it is a political model based as much on absorption as on renunciation, rule, and *vanwas*, exile in the forest. Rabindranath chooses to read the *Ramayana* as the human’s relationship with the forest, with nature, of interest and curiosity and coexistence:

In the *Ramayana*, Rama and his companions, in their banishment, had to traverse forest after forest; they had to live in leaf-thatched huts, to sleep on the bare ground. But as their hearts felt their kinship with woodland, hill, and stream, they were not in exile amidst these. Poets, brought up in an atmosphere of different ideals, would have taken this opportunity of depicting in dismal colours the hardship of the forest-life in order to bring out the martyrdom of Ramachandra with all the emphasis





Rabindranath Tagore (1861–1941) in an undated photograph.



of a strong contrast. But, in the *Ramayana*, we are led to realise the greatness of the hero, not in a fierce struggle with Nature, but in sympathy with it. Sita, the daughter-in-law of a great kingly house, goes along the forest paths.

The worship of Ram, the hero, and of his heroism, which has driven India in the last few decades—the Bharatiya Janata Party owes its ascension to its promise of building the Ram Mandir, a temple to Rama, in Ayodhya where the Babri Masjid mosque once stood; “*Jai Shree Ram*,” Glory to Lord Rama, has changed from an informal Hindu greeting in parts of India to a battle cry during lynching. The overwhelming human-centeredness in this reading of the first epic of the Indian subcontinent is rejected by Rabindranath in favor of a model of forest living that gives dignity to all its residents. Sita, we are reminded, asks questions about all the unfamiliar species she meets in the forest. Only such a life will bring *sachhidananda*, pure consciousness, pure bliss, says the poet. India’s pilgrimage sites, he notices, are in forested hills, where “man is free, not to look upon Nature as a source of supply of his necessities, but to realise his soul beyond himself.” This is Rabindranath’s plant philosophy, and that is how he imagined India—not the nation state, not the garden, where man is king and controller, but the forest and its natural cosmopolitanism; and it was this that he would try to recreate in Santiniketan, the university town and cultural center founded by the Tagore family in the nineteenth century, and especially in the gardens of Uttarayan there, with his son Rathindranath, carrying seeds, grafts, and saplings from his travels to give them a home irrespective of their nationality, and also in nearby Sriniketan.

Rabindranath was not alone. A few decades before Indian independence, some of its writers and artists were imagining India as a state that derived its political structures from the plant world. Bibhutibhushan Bandyopadhyay was one of them. A college graduate, without a job or parental and financial support, Bibhutibhushan had to leave Calcutta for Bihar to become an assistant manager in an agricultural estate. Diary records of his time there, of clearing the forest to make way for an agricultural estate for his employer, would transform into his novel *Aranyak*. Rimli Bhattacharya, the translator of *Aranyak*, notes that the burning of Khandava forest by Arjuna and Krishna is “a necessary prelude” to the events of the Mahabharata, with the forest “consumed by fire to

provide a clearing for Indraprastha whose urbane magnificence is only the site of further dissension.” It is a model that has been replicated everywhere—the burning of forests to raise cities, an idea of the urban that refuses to see the forest as a city in its own right. For Bibhutibhushan, the human’s residency in the forest would seem natural, coming, as it would have, from being conditioned to the reasoning of our epics—both the idea of *vanwas*, exile, and *vanaprastha*, retirement from the worldly life. The forest compels Satya, the protagonist of *Aranyak*, to question the idea of who or what constitutes the category of the civilized: “It seemed to me that people in Bengal had become much too civilized in comparison.” And so Calcutta, the only city Satya has seen, becomes an approximation of a nation state, for the idea of the nation is foreign in non-urban spaces in Bibhutibhushan’s literary world.

Both Rabindranath and Bibhutibhushan are turning to the forest as a political model, a thought system that compels the human to see connectedness over individual benefit. Through *Aranyak*’s protagonist, Satya, whose name means “Truth” (a common name in India), we are given a sense of history of the kind that does not come to us through textbooks:

The forest and hills had been thus for many centuries. So must this forest have been when the Aryans had crossed the Khyber long ago and had entered the land of the five rivers; when Buddha had silently left his home at night ... on that night, long ago, the mountain peaks must have laughed as they do on this moonlit night.... And so it was, when the poet Valmiki, immersed in composing his epic Ramayana in his hut by the Tamasa river must have started to find that the day was gone.... Who had inhabited these forests in those distant times? Not too far away from the jungle, I had ... seen an old woman who could have been anything between eighty to ninety years old ... the absolute embodiment of the poet Bharatchandra’s rendering of Ma Annapurna as an ancient and decrepit woman. Now, I suddenly remembered the old woman—she was a symbol of the civilisation of the forest....

I think of my grandmother, another Annapurna, as I read these passages—the name reveals the relationship with the earth, *anna* meaning “grain” and *purna*, fullness; woman as goddess and granary and land. In paragraphs that follow, Satya criticizes the idea of progress, “the Parthenon, the Taj Mahal, the Cologne cathedral ... the aeroplane, ship, railway,



wireless, electricity,” while “the natives of Papua New Guinea and the ancient aborigines of Australia, and the Mundas, Kols, Nagas, and Kukis of India have not moved on in these five thousand years.”

Satya is induced—inspired—to start planting seeds of wildflowers and plants in the forest even as he gets parts of it cleared. This doubleness seems ingrained in the character of the forest’s fluid cosmopolitanism, so that there can be an ashram inside the forest even as another part is being burnt, where human living is not separate or severed from living with other species, where the word for “hut” and “nest” and “anthill” are the same: *basha*. *Basha* is also the suffix in the Bangla word for “love,” *bhalobasha*, which could also mean *bhalo basha* or “good home.”

Not only can they hold ashrams; forests also have their own kings and their own political systems. “The leader of the Santal Revolt is still alive,” we are told; “he is the present Raja. His name is Dobru Panna Birbardi. He is very old and very poor, but all the indigenous people of the land give him the respect due to a king. He’s still regarded as a king, although he doesn’t have a kingdom anymore.” It seems like an oxymoron in our world—and in Bibhutibhushan’s, with George V ruling the British Empire at that time—that kings could be poor at all. Raja Dobru Panna’s wealth is his natural nobility and the riches of his memory, of his valor: “These forests and the hills, all the earth, was once our kingdom. I have fought against the Company when I was young. Now I am many years old. We lost our battle. Now there is nothing left.” That they and their politics derive from the forest itself is emphasized in many ways: the king’s grandson “had a body like a young sal tree, muscular and supple”; agriculture, that metaphor of human control over nature, “is forbidden to our race.”

The first page of Bibhutibhushan Bandyopadhyay’s novel *Ichhamati*, where we see the terrible effects of the Permanent Settlement Act of 1793, begins with a revolutionary formulation of history, where national history *is* natural history. Both “history” and its Bangla equivalent *itihasa* are etymologically derived from a shared investment in the human: story or narrative of a person’s life; from *asti*, meaning “he is.” Bibhutibhushan changes both the subject and the frame:

Take a boat from Morighata or Bajitpur right up to Chanduria ghat, and you shall see the bright red flowers of the poltey and madar trees on either bank, the aquatic foliage of the bonneyburo, the radiance of the yellow flowers of the wild titpalla

creeper and the floating leaves of topa-pana; sometimes, along a high bank, you will spy shrubs of uluti-bachda and bainchi in the shadow of ancient banyan and pipal trees, the nesting holes of river-mynahs, and everywhere the pleasing spread of creepers and all manner of greens.... On occasion you may sight a vulture sitting atop one of the crisscrossed branches of a tall silk-cotton tree in a stillness suggesting a higher state of spiritual realisation—like a wash painting done by a Chinese artist....

When the moonlight falls on the green grassy fields that have sprung up on the sandbanks where white clusters of akanda flowers blossom in the summer, and the mild breeze from the river sways the golden laburnum along the banks, travellers journeying along the river will sight the remnants of old ruined homes now covered with a profusion of wild akanda.... As you pass by these ruins of homes you will dream of bygone days, of a mother and her son, of a brother and a sister, whose lives were once entwined with these living signs of habitation.

From one century to another many are the unwritten histories of joy and sorrow that lie on their breasts, like the tracery of lines of water in the rains.... Their voices, their stories, are the real history of our nation.

“Real history of our nation.” The history of plant life, records of its settlement on land as well as its death and evacuation from these spaces, a census of plants and trees—all these constitute our national history, not only the life of kings, queens, and the famous. Bibhutibhushan is writing this in a novel published in 1950, the year India becomes a republic and gives to itself its constitution, and decades before the formation of the Subaltern Collective. Seventy-five years later, these words read like a preamble to an imagined India, of what might have been had this understanding of national history been institutionalized. Looking at Gond art in Madhya Pradesh, for instance, with its egalitarian distribution of attention on the natural world, its natural rejection of focus on one species, the species to which the artist belongs, the lines which reveal an interspecies imagination, the use of pigment made from charcoal, mud, leaves, flowers, plant sap, one is tempted to imagine an Indian state like that—the walls of the huts which are the canvas of these paintings, the painters, without formal schooling, so that everyone is allowed the space of creation, this might have been a model for





Freedom of the forest: Apu's sister Durga (Runki Banerjee) in the film version of *Pather Panchali* (1955) by Satyajit Ray, based on Bibhutibhushan Bandyopadhyay's 1929 novel of the same name.

Indian democracy (see Shuchi Saraswat's discussion of *The Night Life of Trees* in this issue, pages 57–59).

In the middle of India's anti-colonial struggle, Bibhutibhushan sees freedom not just as something given to its citizens by the nation state but as a condition of the living, of life. "Freedom" comes from the same root as "friend," someone or something that is dear. When I think of those I feel closest to, those I love, I notice only one thing common among them—they make me feel free. Why does the nation state not make me feel free? Idiomatic usage, anthropomorphic as it is, connects freedom to birds: the freedom imagined in flight, the supposed lack of obstructions to movement in the sky. Plants and trees, on the other hand, are stuck in the earth, unable to move. To be able to imagine them as free, then, is quite revolutionary. This understanding of freedom, possible to access even when movement is limited, comes from science as much as it does from the Upanishads—plant and planet; all planetary bodies, including the earth from where and from which we seek freedom, kept in their place because of various forces, are free—and, in turn, give us freedom—if we are able to imagine them as such.

The joy of pure freedom, never before tasted, had made their young blood sing. They had been in no state to stop and ask for directions, in no state to stop and consider the consequences of running wildly into the unknown ... his sister had realised that she had lost her way. In their glorious run for freedom through the fields, they had seen no villages to *mark the way*: only paddy fields, marshland and thickets of cane.

This is from Bibhutibhushan's novel *Pather Panchali*, on which the filmmaker Satyajit Ray would later base his *Apu* trilogy. The little boy Apu and his elder sister Durga are running through fields, away from their tiny village where their movements are often limited by their economic class, their poverty. The absence of borders, of things that mark divisions, of "no villages," of the lack of humans and their habitats on the way, is what enables this sense of freedom. (Two English writers come to mind: John Clare, the form of whose poems and poetic temperament would be deeply affected by the "enclosures" dividing up the English rural landscape of his time—taming the land, its forest and agrarian spaces, into rectangles—and how it would affect his sense of



freedom; and D. H. Lawrence, who wanted to imagine a space that had not been touched by the human.) The freedom that Apu and Durga experience is the freedom both of the eye and of the limbs—the eyes meet no obstructions, species of plants keep changing, in a form of visual freedom that is akin to looking at the sky but experiencing it through the body, as one imagines birds doing in flight. It is also the freedom of the unknown, of being unshackled from certainty: to see the imprint of the human hand and the human mind is to feel like a dog on a leash all the time, the reason we never feel free, not even on holidays, for “notifications” of various kinds do not allow us to forget that we are employees, not just of corporations or governments or the nation state, but even when we might be our own employee. “At such times, you should feel no less than the famous explorers who charted new lands.... When I visit one, I ‘discover’ it—with my mind, my heart, and with all of my senses. I taste of its newness, and I am elated” (*Pather Panchali*). Freedom is looseness, looseness that gives grace—the reason even swaying coconut trees and falling flowers look beautiful to the human eye. This model of freedom that Bibhutibhushan desires comes from the plant world, and it is one that he seeks from the political system.

That is why he shows the damage caused by European colonialism—he calls a few trees “English trees” all through his novel *Ichhamati*, thereby reminding his readers of how the landscape was being changed by colonial botanists. There is, of course, the indigo plantation, forced on certain areas of Bengal by the British, the cruelty visited both on humans and plants, causing impoverishment to both men and the soil. The introduction of “foreign” trees, seeds, bulbs and cuttings brought by European botanists to Calcutta, its neighboring towns and villages, and to sanatorium towns, began changing the character of plant vegetation as well as the quality of soil. (Richard Axelby, just to cite one example, in his essay “Calcutta Botanic Garden and the colonial re-ordering of the Indian environment,” explains how the botanical garden near Calcutta was changed to accommodate and then give hierarchical importance to migrant plant life.) It isn’t so much the introduction of new species that troubles Bibhutibhushan as the reordering of the natural world and human maneuvering and control over it. Such is the character of India’s plant life, its forests, that even those who are not “Indian,” not born to this land and light, find something in this freedom. The Englishman Colesworthy Grant—“not

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looseness that gives  
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only a painter, but a poet and a writer as well”—in *Ichhamati* had found something in this Bengal. “Rural Bengal had opened up new vistas before his eyes ... dazzling laburnum trees dotting an *unbroken* sweep of fields, the clamor of *unknown* birds from the flowering bushes, shrubs and trees” (emphases mine). How did the Europeans colonize the land? “Luxuriant gardens had once been planted on either side. Huge trees, English trees that Robson Saheb had planted—all of which now made the graveyard heavy with darkness.... Who gave a hoot for it now!” They also colonized a manner of seeing and its concomitant worldview—“spotless and shining,” a phrase used for the English idea of beauty, an utterly human ascription and prescription, is never used for plant life that shares an ancestral relationship with the landscape. “Spotless and shining” is thus turned into an indictment.

To encompass a concept bigger than “India” or any geographical territory, Bibhutibhushan uses the word *Bharatvarsha* to indicate something more than the concept of “nation” can hold. A world of more-than-human citizenry, a state where the plant and



animal and elemental world have equal claims and rights. In *Ichhamati*, for instance, that word is inaugurated by “the scent of fragrant flowers” and “the green spreading fields of autumn-paddy.”

This is India, *Bharatvarsha* ... Colesworthy Grant mused. He had been wandering all over the country.... The India that he had glimpsed through Monier Williams’s translation of *Shakuntalam* and in the poetry of Edwin Arnold—for which he had come so far; now at last in all his sojourn he had a sense of a different world, exquisitely beautiful, resonant with poetry—on the banks of a river in this obscure little village in the fading afternoon light. He felt it had been worth all his travelling.

An India imagined through literature, a map, a *Bharatvarsha*, encountered through experience. Whether the village or the forest in *Aranyak*, where one of the forest dwellers asks about the location of *Bharatvarsha*—“Have you heard the name ‘Bharatvarsha’? Bhanmati indicated by shaking her head that she had not heard of it. She had never travelled beyond Chakmakitola. In which direction was Bharatvarsha?”—it seems that Bibhutibhushan is hinting towards a sense of the country being not in its cities. Only in these forest spaces can one feel “the nurturing spirit of the earth, goddess Jagadhatrī herself.”

While resistance and disobedience movements against the British by Indians, by the subcontinent’s political thinkers, have been widely studied, it might have been fruitful to think of the many writers and artists who turned to the plant world unconsciously for models outside the hand-me-down European political models such as the nation state. Besides Rabindranath and Bibhutibhushan, there was Kazi Nazrul Islam, for instance, who responded to strained Hindu-Muslim relations and consequent riots with a song such as *Mora aeki brintey duti kushum Hindu Mussalman*: “we are two buds on the same stem, Hindu and Muslim.” There was Sukumar Ray, arguably Bengal’s finest nonsense poet, who created a poem out the metaphor of the “Biswatoru,” combining *Biswa* world and *toru* tree: A “world-tree,” a rejoinder to the narrow confines of the nation state. And there was Jibanananda Das, who tried to imagine a political system in at least two possible ways: by thinking of plants and history, a sense of natural continuity that could exist without human interference; and by turning to grass as a socio-political model. In “Ghash” (“Grass”), a poem from his collection

*Banalata Sen*, grass is turned into something epic, an aesthetic that was usually reserved for “trees”; I’ll paraphrase:

*the world is filled with the soft green light of tender lemon leaves; grass like unripe pomelo— a similar fragrance—the deer are tearing it with their teeth! I, too, feel the desire to drink the fragrance of this grass in glassfuls like green wine, I mix and grope this grass’s body—I rub it on my eyes, the wings of grass are my feathers, I am born as grass inside grass, dropping from a dense grass-mother’s dark delicious body.*

Grass becomes metaphor—it is the poetic, and it is also his politics, a natural analogy for the human, to *humanitas*, to humus, to humility, all related to the soil to which grass clings. It is that smell that he seeks—as if by becoming grass he can find secrets of soil and depths that the human body, with its vertical life, has made him forget. “Suranjana,/Today your heart is grass,” he writes in another poem. What does it mean, to have a heart of grass? It is as if life—this world, this world of space and of time, time that he tried to stalk and understand—was composed of grass. Grass, fields of grass, without beginning and end, as infinite as the human heart. It is as if Jibanananda was proposing the rhizome as a counter-model decades before Deleuze and Guattari, the French theorists famous for their talk of the rhizomatic nature of culture and the mind. For Jibanananda seeks to return to earth and its history over and over again, not as tree but as grass.

Seventy-five years after Indian independence, as forests are destroyed and their dwellers turned into refugees, I sometimes imagine what might have happened had the Indian nation state been patient with the thoughts of these plant thinkers of early twentieth century Bengal—what my country could have been, had we modelled our political systems on the ethics of the forest and grass.

Alas. 🌿

SUMANA ROY is the author of *How I Became a Tree* (2017), *Missing: A Novel* (2018), *Out of Syllabus: Poems* (2019), *My Mother’s Lover and Other Stories* (2019), and *V.I.P.—Very Important Plant* (2022). She teaches at Ashoka University. Her poem “The Cherry Blossom on Rüttenscheider Straße” appeared in *Arnoldia* 80:1 (Spring 2023).



## The Elms, or Trans-sensory Experience, Courtesy of Santiago Ramón y Cajal

By Louis Girón

Professor, for me, this day is a new tissue stain,  
like the ones you coveted for your microscopy,  
and like the one your rival, Golgi,  
said you stole from him, the silver stain  
that can distinguish nerves from other cells  
and one kind of nerve from another.

This day stains these elms, oaks, sycamores  
and maples along my customary walk.  
Some leaves have fallen. Walnuts roll  
beneath my boots. Pale trunks rise gaunt,  
bent against the wind. Skeletal refugees  
who trudge and trek along the ridge.  
Some will endure.

You, of all people, would require  
that form serve function  
and would say that function demand form.

To some, the trees in shape resemble peasants  
leaning forward, working fields long after the lord  
has gone to a doxy-warmed and brocaded bed.  
To others, they recall the Burghers of Calais,  
spines straight, struggling for dignity as they clutch  
robes, caps, or the signs of their offices,  
awaiting the pleasure of their executioner.

Yet, knowing only the shapes  
of nerves as you have shown us,  
we cannot explain how we see or hear.  
And no understanding of the connections  
between nerves has yet explained  
why we love or pray.  
You have left mysteries enough for us.  
We must start with what you have left us to see.

To me, by the light of this day,  
the elms are shaped like the neurons  
revealed by your stain.



They distribute in arrays  
as in the *arbor vitae* (a fitting name)  
of the cerebellum and in other  
well-ordered geometries of like neurons.

You, even in your atherosclerosis,  
would have apprehended at once  
how changing winds, competition for the sun,  
position along the incline,  
the intent of the arborist, lightning,  
rain, blight, composition of the soil,  
and the scurrying of maddened squirrels  
had so altered the shape, height, bark,  
and line of these swaying trees  
from their archetypes  
and from their idealized arrays.

These trees persevere, sensing,  
adapting to, and transforming themselves  
and the forces that play on them.  
They plunge roots into the earth;  
taste, move, and renew the soil.  
Their leaves and blossoms seek light.  
They dance stately pavaes to the turns of the seasons,  
bear fruit, give shade, share life.

Because of the recollection  
of your stains  
and of your conceptions

and because of the power  
of the stain of this day,

reaching  
with their tongues and fingers  
and with the agency of these elms  
as nerves,

for the first time.  
I taste the wind and touch the sun.



INSTITUTO SANTIAGO RAMÓN Y CAJAL

LOUIS GIRÓN is a recovering neurologist and former battalion surgeon who came to poetry late, after a complete poem dropped into a research proposal.



VISUAL ESSAY

# Forest Fashion

By David Buckley Borden and collaborators

Amid forest fires and watering bans, air-quality alerts and atmospheric rivers, we see a new culture arising among people who go hiking in the backcountry of the Pacific Northwest. How might this new folk seek to reconcile past Western land-management practices and contemporary conflicting cultural histories? What timely knowledge might such a society offer in the midst of planetary crisis? In landscapes of rapid change, alongside those who've known the land far longer than modernity allows, the goods dreamt up by these Anthropocene wanderers have evolved from speculative niches in academia to a burgeoning bazaar of Pollyanna technologies and nuanced neo-tribal narratives spanning a spectrum from savvy hope to existential despair. Perhaps they signal an emerging reconciliation between conflicting cultural histories of land use in the forested backcountry of the Cascades?

Anthropologists hold that every artifact possesses a cultural backstory legible in design—every stitch, every screw an archive of creativity and folk knowledge. Some of these narratives speak through vagaries of form—the mouth-sized spout on a canteen; the flared axe handle, smoothed and weighted for ergonomically-efficient destruction. Other stories are only revealed upon rigorous research, including the acquisition, restoration, and re-creation of objects long lost or never known by outsiders. In this way, every object in the *Forest Fashion* collection communicates a story of human creativity, resiliency, and adaptation.

- 1 *EWS Map-n-Chart Case*
- 2 *Cathartes aura Water Bag*
- 3 *Timber Totes Haul Straps*
- 4 *Commemorative Oil Can*
- 5 *T3 Comfy Camp Slippers*
- 6 *Dehydration Gauge Canteen*







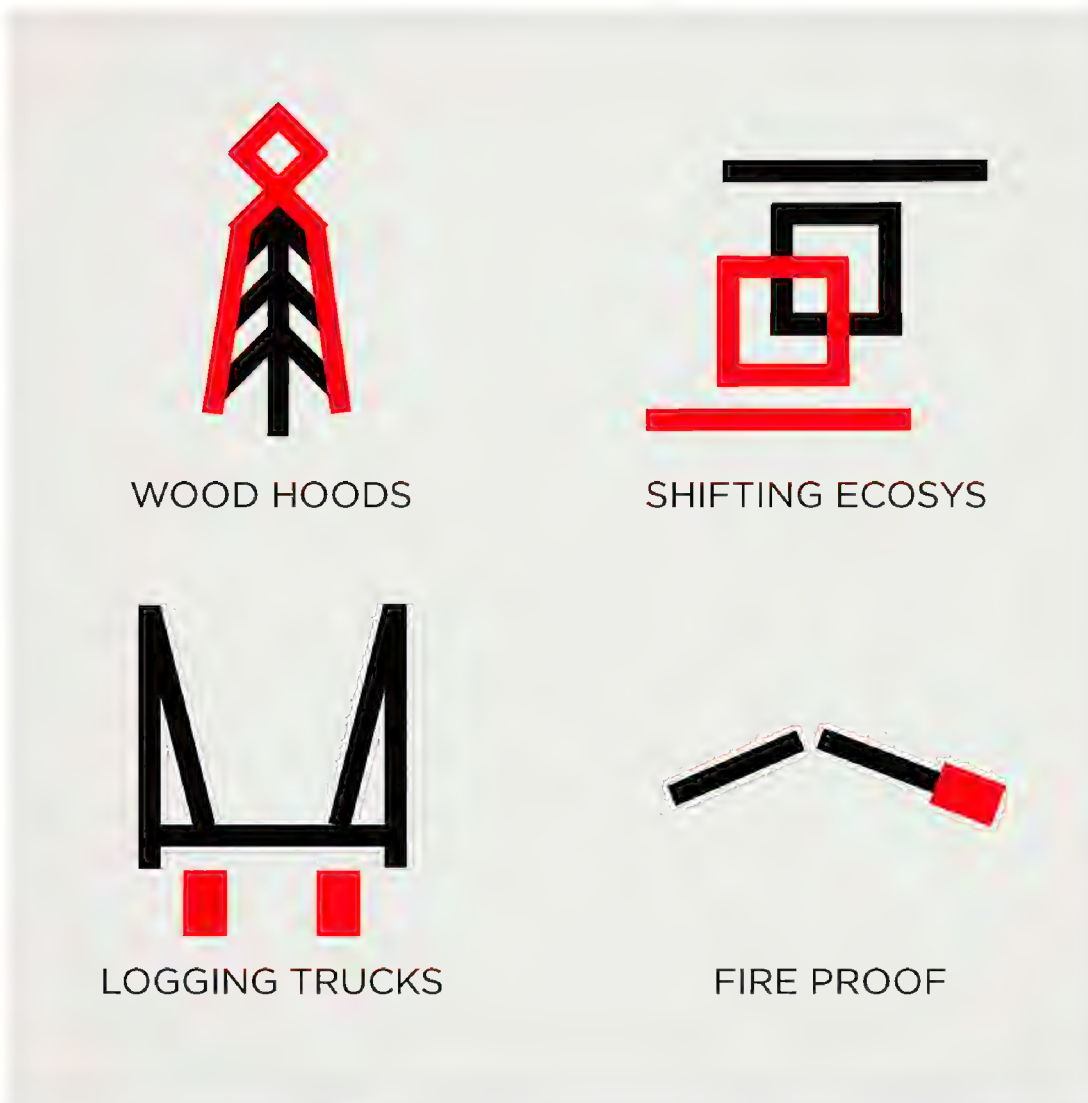




### Environmental Wayfinding

**System:** Building off traditional “hobo” pictographs, the *Environmental Wayfinding System* (EWS) is a reimagined folk communication system that serves as a graphic survival-code for people navigating environmental collapse in the Anthropocene. A living graphic language constantly evolving in response to ecological developments and human understanding, EWS is often informally shared among its users, and has been recorded across North America, ranging from the scorched mountains of the Pacific Northwest, to the desiccated fly-over flats of the Dust Bowl 2.0 region, to the swamped back alleys of American coastal cities, most notably Washington, D.C.

Given the strength of the community’s practice of sharing ideas, it is not surprising to see EWS signs and symbols incorporated into handmade crafts, where they can communicate, teach, and disseminate the system’s broader message. Documented examples of EWS objects include camping equipment, quilts, furniture, hand tools, and even toys and clothing for children.





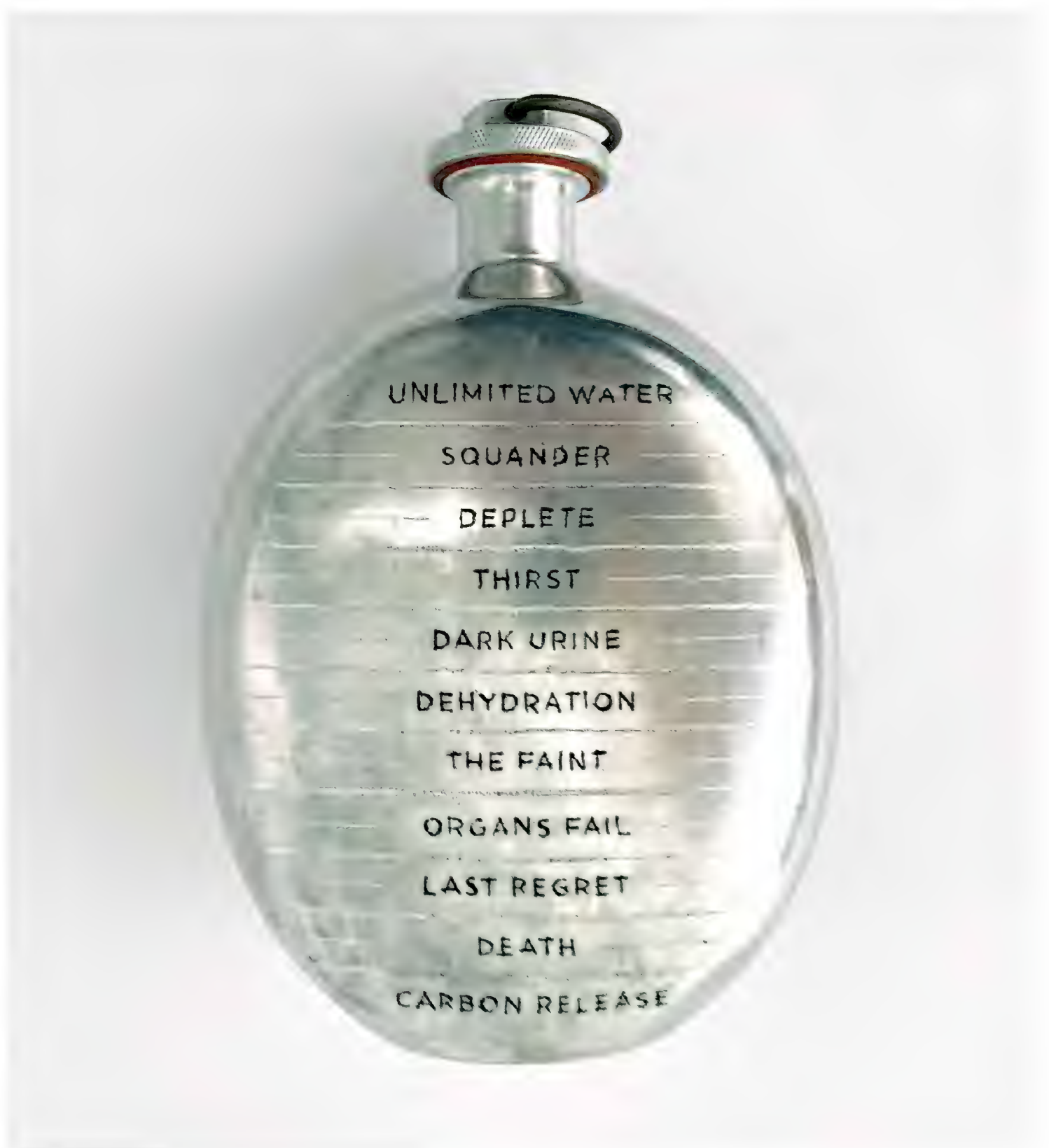


*Environmental Wayfinding System* in the landscape. The three **EWS symbols** painted on a sugar maple in Petersham, MA communicate a forbidden landscape (top symbol) of ghost forests (middle) and the presence of deadly pathogens (bottom). The symbol for “Kool Aid” appears faintly in white paint on the hooded sap bucket, indicating that the pail offers some temporary relief to worn-out travelers with hard trails ahead.









This **Mega Drought Dehydration Canteen Gauge** belonged to a young scientist who studied snowpack modeling for flood forecasting, water resource management, and climate studies. The scientist was lost in an avalanche during the late winter 2021 field research season in the Cascades of southern Washington state. His hand-engraved canteen was found the following summer off the coast of Sendai in the Tohoku region of Northeast Japan. At the time of retrieval, the canteen contents still smelled of sour coffee.



CONTENTS

*Sawdust trail treats*

*Dehydration canteen*

*All weather matches*

*Emergency M.A. pill*

*Cap-n-trade tube*

*Soltero sock (IYKYK)*

*GPS scrambler*





| FEATURES                                   | BENEFITS                                   |
|--------------------------------------------|--------------------------------------------|
| <i>Marine-grade canvas backing</i>         | <i>Indestructible material (plastic!)</i>  |
| <i>plywood frame from dumpster</i>         | <i>Renewable, “free-to-me” material</i>    |
| <i>Reinforced lining illustrating</i>      | <i>Made to last, not to profit</i>         |
| <i>decoded EWS symbols</i>                 | <i>Decoded survival knowledge</i>          |
| <i>Blood-red bandanna featuring</i>        | <i>High-viz neo-enviro identification</i>  |
| <i>classic wetland nerd pattern</i>        |                                            |
| <i>Hand-carved slingshot made</i>          | <i>Low-tech, low-budget defense</i>        |
| <i>of proprietary wood product</i>         |                                            |
| <i>Stainless Kregs for ease of</i>         | <i>Stainless screws are sweet</i>          |
| <i>maintenance and repair</i>              |                                            |
| <i>Live cottonwood “whips” in tube</i>     | <i>Tactical unsanctioned tree planting</i> |
| <i>double dipped in fertile funk No. 5</i> |                                            |
| <i>Adjustable tube straps and</i>          | <i>Comfortable, dry mid section</i>        |
| <i>leak-proof macro-plastic cap</i>        |                                            |

***The Trapper Keeper: Annotated Contents, Features, and Benefits for a Backcountry Hike to a Wildfire Lookout Tower***

Packed with a variety of field tech, survival gear, and choice creature comforts, the **Trapper Keeper** is essential to support long treks to remote destinations. The pictured pack is a modification of the traditional, government-issued, wood-frame design, with tactical pockets for bodily autonomy, a plywood frame for easy peel-and-burn kindling, a wet tube for bare-root saplings, and a reinforced cotton lining featuring a decoded *Environmental Wayfinding System* print.

DAVID BUCKLEY BORDEN is a Fuller Design Fellow at the University of Oregon. He created *Forest Fashion* with Rachel Benbrook, Asa DeWitt, Helen Popinchalk, Nancy Silvers, Madison Sanders, Blake Schouten, Ian Escher Vierck, and Sabine Winkler. The work was funded by the Fuller Initiative for Productive Landscapes, the Ford Family Foundation, and the OSU Foundation’s Andrews Fund.







# Propagations

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ART ENTANGLED

## Night Trees

By Shuchi Saraswat

One winter night a few years ago I was woken by the wind, and, unable to fall back asleep, I decided to walk around my apartment, to still those thoughts that intensified the longer I laid in bed. I walked around my small apartment, I paced really, when suddenly, I came upon the silhouette of a tree. It was a shadow, cast by a neighbor's tripped floodlight, this much I could intuit even in my half-awake state; but these elements—wind, tree, floodlight—had never before found each other in this particular arrangement. The shadow-tree and I faced each other. It was immense. Its limbs and trunk extended all the way to the edges of the coat closet door, as if it knew it was in frame. Likely it was a Norway maple (*Acer platanoides*)—common enough in my Boston neighborhood as to have become nearly invisible—but isolated and in shadow it had become mysterious, its upper twigs ghostly and faint, swerving, intersecting, flickering; *moving*. Our encounter lasted only a few minutes, but I haven't forgotten it—in part because the shadow-tree hasn't appeared again since. It was there, then gone.

Our ability to see diminishes in the dark. The air texturizes, a grainy film that muddies colors, disappears objects. What we see best are the edges of things, and our mind fills in the rest, pulling from experience, supposing, guessing. With the loss of one sense comes the sharpening of other senses, and sometimes, a retreat into the caverns of the mind, where fear grows, but imagination too. How many fairy tales, fables, and myths there are of people lost in the forest, within the land of the trees, afraid of the encroaching night, sealed, impenetrable, from which the only relief are thoughts of escape, moonlight. Light. The less you can see, the stories seem to say, then the more danger you are in.

The Gond tribe, indigenous to the forests of central India, have several such stories. In one, a cowherder and a young calf enter the woods during July's monsoons, in search of the calf's mother. Cloudy skies, a dense, wet forest; soon, cowherder and calf are lost, in despair. A firefly watches and decides to help. She guides the pair to a Sembar tree, alight with more fireflies. Under it, the lost cow waits.

This fable is part of *The Night Life of Trees* (Tara Books, 2006), an art book that takes the form of a children's picture book, pairing Gond folklore with paintings by one of three prominent Gond artists silk-screened on thick, black paper. Ram Singh Urveti visualizes the Sembar as a bright green apparition with a skin made of tight, oval scales, saffron colored beams—the fireflies—flaring from the branches' partings. The tree floats in the center of the page, borne from it, fabulously unrooted; the Sembar does not recede as the night arrives, but becomes more alive.

The fable comes with the expected lesson—this one being that if you are lost in the woods, then look for a firefly or a Sembar and you might be saved. My Western-educated mind intervenes: *what kind of tree is a Sembar?* Mostly likely *Bombax ceiba*, but the painting offers no confirmation.



Urveti and the two other artists contributing to the book—Bhajju Shyam and Durga Bai—are mostly concerned with expressing their ancestral connection to the natural world.

The Gonds are one of the largest of the tribal groups living in India. The artists belong to the Pardhan Gond clan, historically the bards and singers, carriers of their communities' stories. Visual art is central to their way of life. For festivals, they use colored mud and organic materials to decorate the walls and floors of their home with geometric designs known as *digna*. Durga Bai, who paints five of the nineteen illustrations in *The Night Life of Trees*, began as a *digna* artist at the age of six. She, like many established Gond artists, considers Jangarh Singh Shyam her mentor. Shyam is noted as one of the first among the Gond to use paper, canvas, and synthetic paints, and to gain international, institutional recognition for his work. Many followed him, leaving the village for Bhopal, Madhya Pradesh's capital city. In the biographical note to another book Durga Bai illustrated with her husband, *Bhimayana: Experiences of Untouchability, Incidents in the Life of Bhimrao Ramji Ambedkar* (Navayana, 2011), she describes the move: "Jangarh-jija and his wife Nankusia invited many talented artists like us to the city, gave us shelter, and helped us explore the world of contemporary art. They are the deep roots of a large tree. Subhash and I are one of the branches on that tree. We owe everything to them."

Trees—metaphorical, mystical, useful. In *The Night Life of Trees* humans turn into trees; deer are mistaken for them. A squirrel dreams of having another body, only to realize there's nothing better than being a squirrel sitting in a tree. "The Tree of Intoxication" warns that the liquid extracted from the flowers of the Mahua (*Madhuca longifolia*) may heal ailments, may even be enjoyable to drink, but too much will turn a person into "a mouse or a tiger, a pig or a pigeon." In that painting—by Durga Bai—the severed heads of the three creatures are stacked within the column of the trunk, maniacally in wait. The Peepal (*Ficus*

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is a writer based  
in Boston.

(Near right) image from *Dream Villa* by Dayanita Singh. Copyright © 2010 all rights reserved.

(Far right) "The Tree of Intoxication" by Durga Bai, from the book *The Night Life of Trees* by Bhajju Shyam, Durga Bai, and Ramsingh Urveti. Copyright © Tara Books Pvt Ltd, Chennai, India.

*religiosa*), as illustrated by Bhajju Shyam, is one of the few which retains its autonomy. Illustrated in tidy, long lines, it slopes upward, contained. The accompanying text describes the Peepal as being "so perfect that seen against the sky, it seems to have the same shape as its own leaf. The detail is the same as the whole."

The last page collects all nineteen paintings in silhouette on a sheet of brown kraft paper. It reminds me of one of those dendrology charts in which the trees are labeled by their shape—*pyramidal*, *round*, *broad*, *oval*, *columnar*, *weeping*. Except here, they are a gathering of shadows, catalogued by artist name. It's like seeing the paintings in negative; without their intricacy, they appear like dancing figures, returning to the cover of night.

Night arrives in the city. It falls (or does it rise?) and at once it is tempered by the lit squares of windows, streetlights, the twin beams of passing cars. It's a filled night, crowded still, even as it empties of





human activity. “And what greater delight and wonder can there be than to leave the straight lines of personality and deviate into those footpaths that lead beneath brambles and thick tree trunks into the heart of the forest where live those wild beasts, our fellow men?” writes Virginia Woolf in her essay, “Street Haunting.” Delhi-based artist Dayanita Singh evokes this sense of communion in her book of night photography, *Dream Villa* (Steidl, 2010) a work that I think of as an urban sibling to *The Night Life of Trees*. Also set against a black sky looming with forms, it speaks in similar, if duskier, reds, greens, blues. Trees are not the subject, but neither is any one being or object; the photographs’ focus appears almost accidental. It’s the light that dominates, its peculiar insistence. All are joined in its artificial glow.

Singh considers her books “photo-novels” yet *Dream Villa* contains no accompanying text. I think of Woolf’s “straight lines of personality”—our attachment to our self as Self, perhaps? or maybe to

narrative, to sense-making?—and the relief in temporarily abandoning verbal language’s responsibilities, the human impulse to create order.

That night I paced, it was, I’m remembering now, the news of the day that kept me awake. Scrolling headlines. I walked to resist picking up my smartphone; once exposed to that blue light, I wouldn’t be able to fall back asleep. After I encountered the shadow-tree, my worries didn’t leave me, not quite. But another image flashed before me—this one of Ramón y Cajal’s drawings of Purkinje cells, the neurons that live in the back part of the human brain. Filigreed, liquidy—dendritic. That we contain cells resembling trees—there is a little comfort, in that. 🌿





## INTERVIEW

# Sean Hoban on Genetic Diversity and Diplomacy

In December of 2022, Sean Hoban (tree conservation biologist at the Morton Arboretum in Lisle, Illinois) traveled to Montreal, Canada to attend the United Nations Biodiversity Conference, also referred to as COP15 (the 15th Conference of the Parties). The conference brought together the Parties to the UN Convention on Biodiversity (CBD), which was opened to signatures in 1992. As of 2023, the CBD has been ratified by 192 countries, though not by the United States. The CBD has three stated goals: the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from genetic resources.

Hoban attended COP15 as a scientific advisor, advocating for the consideration of genetic diversity. While the concept of biodiversity is most often associated with a great number and variation of species, genetic diversity refers to variation *within* species. A species with high genetic diversity displays a wide variety of inherited traits—which is a fundamental, though often overlooked, basis for the resilience of biodiversity. A notable outcome of the Convention was the adoption of the Kunming-Montreal Global Biodiversity Framework (GBF). The GBF contains several goals, notably the “30 by 30” target, which is a global initiative to designate 30% of the earth’s land and oceans as protected areas by 2030. Additionally, there were major advances to conserving genetic diversity.



**ARNOLDIA:** First, tell us about your journey to the Morton Arboretum. How long have you been there? Did public gardens factor in your research before this?

SH: I've been at the Morton for seven years. I have worked on trees and tree genetics since my Ph.D. My dissertation research was on butternut (*Juglans cinerea*), a tree threatened by an exotic fungus, and trying to understand the genetic impact of this disease, as well as the genetic impact of hybridization. The situation is actually very similar to American chestnut: hybrids may help save the species, but to some degree we also want to save the native gene pool of the species, so there's some trade-off there.

My postdoctoral appointments turned in the direction of policy and public impact. My first postdoc was focused on translating genetic knowledge to non-geneticists—people in policy, people in government agencies. It was actually in Europe, so I was working with some European agencies—hosting workshops, developing tools and reading material—to connect genetic scientists to conservationists, protected-area managers, and people who are setting policy.

My second postdoc was what really propelled me towards the garden world. That was when I started to work on the genetic implications of how we sample seed for ex situ collections. It was actually a competitive proposal that I wrote for an NSF-funded postdoc: I had this idea that we could use simulations to create a species on a computer, and then apply different sampling strategies to that simulated species to test out how well any sampling design would work, in simulations that could account for species with varied biology or geography. And that's been a major core of my work for almost ten years now. During that postdoc, I was invited to a couple botanic gardens to talk about the seed sampling work. I was invited to what was then Rancho Santa Ana Botanic Garden (in Claremont, California; now the California Botanic Garden). I think that was my first visit to a research site of a botanical garden. And then I was invited to Kew, where I collaborated with researchers

Some species are experiencing phenological mismatches due to their migration, while others will not be able to move and therefore will have to adapt.

on ash (*Fraxinus*) seed collections, and to the US National Seed Bank, to better understand how their seed bank works and to start some collaborations. Visiting those three places made me realize that there is this alternative research pathway—previously, I was focused on either working as a geneticist for the Forest Service or trying to get into academia. The new collaborations I made in that year opened me up to the garden world.

**You put genetic diversity on the table in a big way at COP15. How did that go? Do you feel like genetic diversity is on the table in the way it needs to be? Is there a change happening in the dynamic around the global biodiversity framework?**

SH: I think genetic diversity is increasingly a consideration among conservationists, including in the COP15 discussions. Over the past decade, we've developed a shared understanding that species are either moving or adapting already: some species are experiencing phenological mismatches due to their migration, while others will not be able to move and therefore will have to adapt. In the media and getting into the policy conversation, there is acknowledgment that trees, including those in agricultural production, are really affected by climate change, and an awareness that genetic diversity can help alleviate some of those impacts. News stories of coral die-offs, with research showing how genetic diversity can help rescue those populations, has contributed to this awareness as well.

With broader recognition of climate change and the importance of genetic diversity in species survival, we see conservationists starting to implement genetic rescue, where they are moving individuals among populations. The Forest Service is starting to experiment with how far we will have to move seeds for reforestation. I think in conservation practice it's becoming a more familiar topic, and that bubbles up to the policy level.

At COP15, genetic diversity was a topic of discussion, though it was not as prominent



as the discussions on species and ecosystems. The COP15 process was broader than biodiversity—it was also about sustainable use, financing and resources to protect biodiversity, and sharing the benefits of biodiversity equitably. But in terms of biodiversity per se, it's still largely about species and ecosystems, the 30 by 30 commitments in particular, which are important and valuable. A lot of the time was discussing definitions of “protected area,” priorities for protection, and rates of extinction, which is hard to measure. We need something more measurable. With genetic diversity, we can ask, how do we measure threat change to species and their abundance? And from there, we can explore whether there's a percentage of genetic diversity that we can measure that's as easy to communicate to the public as 30 by 30.

I was pleased to see that it came up, though, and it seemed that policymakers are understanding that this is a really important component of biodiversity that had previously been overlooked, one that is important for global adaptation of societies and nature.

**So genetic diversity is on the docket for policymakers, though the concept may still be elusive for the public.**

SH: It's definitely harder to communicate the science around this, to visualize genetic diversity, to boil it down to simple concepts. We need to say that “whether a species occurs across a large area or in distinct habitats, there often are local adaptations, and these need to be protected.” So just thinking about this in terms of the resilience provided by adaptations to different habitats, which will help the species survive whatever changes come. So one science communication approach is to talk about the resiliency it provides. Another approach involves talking about how these genetic distinctions, which have evolved over millions of years, are essentially irreplaceable, in the same way that species are irreplaceable. The loss of genetic diversity is a distinct piece of nature being lost, even where species-level extinction is avoided.

**Sean Hoban** is the tree conservation biologist for the Morton Arboretum, where he works to understand, document, and address threats to species of *Quercus*, *Juglans*, *Populus*, and *Pinus*.

**This notion is especially inspiring—cultivating a sense of wonder and appreciation for genetic diversity at the local level, understanding that each of these variations are irreplaceable treasures. And it feels like that's a place where gardens and arboreta can be effective, by highlighting that micro-diversity.**

SH: Absolutely! I think botanic gardens can highlight this very effectively, because we already show different forms that are exciting to people, whether they're cultivars or different varieties or from different locations. We often have accessions that come from different parts of the world. So when you start to show phenology, you can see phenological differences in the same species. There are so many ways to actually see genetic variation in botanic-garden plants.

**It must be challenging to navigate spaces like COP15, engaging with policymakers, government bodies and NGOs, and addressing the complexities of these networks that operate at very different scales and have very different professional idioms. What's it like to navigate these as a scientist? What have you had to develop in terms of your skill set and practice to engage at these different levels?**

SH: It was the most stretching I've done outside my skill set. Moving into COP15 and talking with negotiators from various countries was a really different, difficult world. The people who attend COP15 include scientists, NGOs, Indigenous representatives, and others. But the primary cohort is people from ministries of the environment or similar agencies who are representing their governments. And this meant there was a whole new set of terminology and acronyms to learn, as well as a huge adjustment of the level at which I speak, and the speed with which people want answers—and by the same token, the slowness with which the whole process proceeds. Policymakers need answers very fast and in a nice, easy-to-read form. So there are slow processes and very fast processes, sprints and marathons.



**Which prompts another question: what effect has it had on your lab group? Does it change what's possible for junior members of your lab in terms of training, skill-building, and networking?**

SH: I think it will. The past couple of years was just me getting my footing in this world, and now I'm starting to translate that to my lab group, to people at the arboretum, people at other gardens and U.S. agencies. Now that a few of us are comfortable in this experience, we can start to bring more people into it, whether by attending these meetings, participating in webinars or training sessions, or contributing to some of the science-communications efforts. I think there's a lot of opportunities for early-career people to now take part in these activities and learn a lot from them. I think compiling case studies of plants where we have clear instances of genetically distinct populations, or really small populations that are losing genetic diversity—early-career people can be involved in all of that.

We need to think about those species that are ready for restoration now.

**Beyond shaping visitor experience into more of an encounter with biodiversity and genetic diversity, how should gardens be thinking about genetic diversity in collection development?**

SH: Gardens have made amazing efforts to get plant species into collections. I think there are probably at least three things that gardens need to emphasize with respect to genetic diversity. There is a need to focus more on wild genetic diversity, instead of sourcing plant material from other gardens or from nurseries. Supporting, or at least receiving material from, new seed-collecting and plant-exploration expeditions, taking advantage of these opportunities to get new genetically valuable material into collections, is terrifically important. We could also retool propagation protocols to make sure that seeds survive. All this will take some hard decisions around de-accessioning material that is not wild-collected or lacks provenance information. And then, thinking about how we propagate plants over time, especially for shorter-lived

plants. There's not as much urgency for an oak that lives for two hundred years. But for those species with ten, twenty-year life spans, well, when these reach the end of their life span, do we go back to the wild populations to get more genetic diversity? Or do we do what zoos do, and try and mate individuals among botanic gardens?

And then of course, gardens need to share data. More and more gardens are participating in Botanic Garden Conservation International's data-sharing efforts, but there's a lot of progress to be made there, because the data is important not only for identifying species to protect, but for finding gaps in species ranges that haven't been protected.

And then—ultimately—building on a colleague's idea, I've recently been saying that botanic gardens are a waypoint on the path to restoration. We need to think about those species that are ready for restoration now, where habitat has been restored, so that we can get some of those species and their genes back into the wild.

**Any final takeaways?**

SH: I think sometimes there's skepticism about whether politicians care about science and whether some of them distrust science, etc. But my experience at COP15 suggests that most policymakers truly care about science. Just like the rest of us, they were working 12- to 14-hour days through that whole two-weeks of COP15, talking to scientists, and really doing their best. I was happy to see how peer-reviewed results and community consensus in science were really important.

*This interview has been edited for length and clarity. 🌿*





# A Plant Explorer’s Packing List

By Miles Schwartz Sax, Assistant Curator

When packing for a plant exploration trip, it’s crucial to bring the right supplies to accurately both document the journey and the flora experienced—and to safely bring plant propagules back home.

For Arnold Arboretum expeditions, we sort supplies into four distinct categories related to the activities undertaken in the field. The first category is *field documentation supplies*, used to record information about sites visited and plants collected, and includes items such as journals, GPS units, and digital cameras. Second is *herbarium supplies*, used to preserve dried samples of plants allowing for taxonomic study and identity verification and include wooden presses, blotter paper, and newspaper. Third, *propagation supplies*, includes items used to collect seeds and living plant propagules, such as pole pruners, labels, and a multitude of bags of varying sizes and materials. The fourth category is *personal items*, which enable the collector to deal with the vagaries of the weather and travel across varied terrain, times zones, and cultures. A full packing list and discussion of plant exploration methods may be found in *The Arnold Arboretum Expedition Tool Kit: A Reference Manual for Expedition Plant Collectors*, by Robert Dowell and Michael Dosmann, available online. 🌿

Photograph by Miles Schwartz Sax

117

Plant exploration trips in which the Arnold Arboretum has participated.

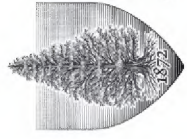
131

Different types of items suggested to pack on a plant exploration trip.









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“That we contain  
cells resembling trees—  
there is a little comfort,  
in that.” — p. 59

